Transportation Discipline Report

in support of Addendum to the
Final Environmental Impact Statement
SR 520/West Lake Sammamish Parkway to SR 202

Prepared for

Washington State Department of Transportation

May 2006

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Transportation Discipline Report

Purpose of this Report

This Transportation Discipline Report is an update to the 1992 *Final Environmental Impact Statement, SR 520 Old SR 901 Interchange to SR 202* (hereafter referred to as the 1992 Final EIS; WSDOT 1992). Although the 1992 Final EIS was accepted and completed, construction funding was unavailable until more recently (2003) when the State's Nickel Funding Package was approved. Given the lengthy time duration that has lapsed since the 1992 Final EIS was published, an update is required by State law. Additionally, the City of Redmond has seen substantial changes in land use and background traffic in the past 15 years. This update maintains the same study area boundaries as assumed in the 1992 Final EIS, along with most of the proposed build improvements. Several differences exist between the 1992 Final EIS and this update and are outlined below.

This Transportation Discipline Report (TDR) presents updated transportation conditions and analysis within the study area and provides a comparison to what was considered in the 1992 Final EIS report. This report is a technical appendix, Appendix F, to the *State Environmental Policy Act (SEPA) Addendum to the Final Environmental Impact Statement for the SR 520/West Lake Sammamish Parkway to SR 202*. This TDR presents existing transportation information for roadways in the study area and reports predictions of transportation performance under two proposed alternatives evaluated in the Final EIS: the No-Action Alternative and the final portion of the Preferred Alternative (Stage 3 of Alternative 4).

Study Area

The study area (Figure 1) follows State Route (SR) 520 from the West Lake Sammamish Parkway interchange to the SR 202 interchange, between SR 520 mile posts (MPs) 11.39 and 13.18. Intersections studied in the area include those at ramp terminals, along SR 202 from 170th Avenue NE to 180th Avenue NE, and those along Avondale Road NE, from NE Union Hill Road to Avondale Road Extension.

Alternatives

Two alternatives are analyzed in this Transportation Discipline Report, the No-Action Alternative and the Build Alternative. The alternatives are described in detail below.

The No-Action Alternative assesses future roadway operations conditions if the proposed project were not built. The No-Action Alternative provides the basis for measuring and comparing the project's Build Alternative. All other programmed and planned changes to the land use and roadways anticipated to be complete are included as part of the No-Action Alternative (see Analysis Methodology section). It is assumed that ongoing Washington State Department of Transportation (WSDOT) roadway maintenance would occur.

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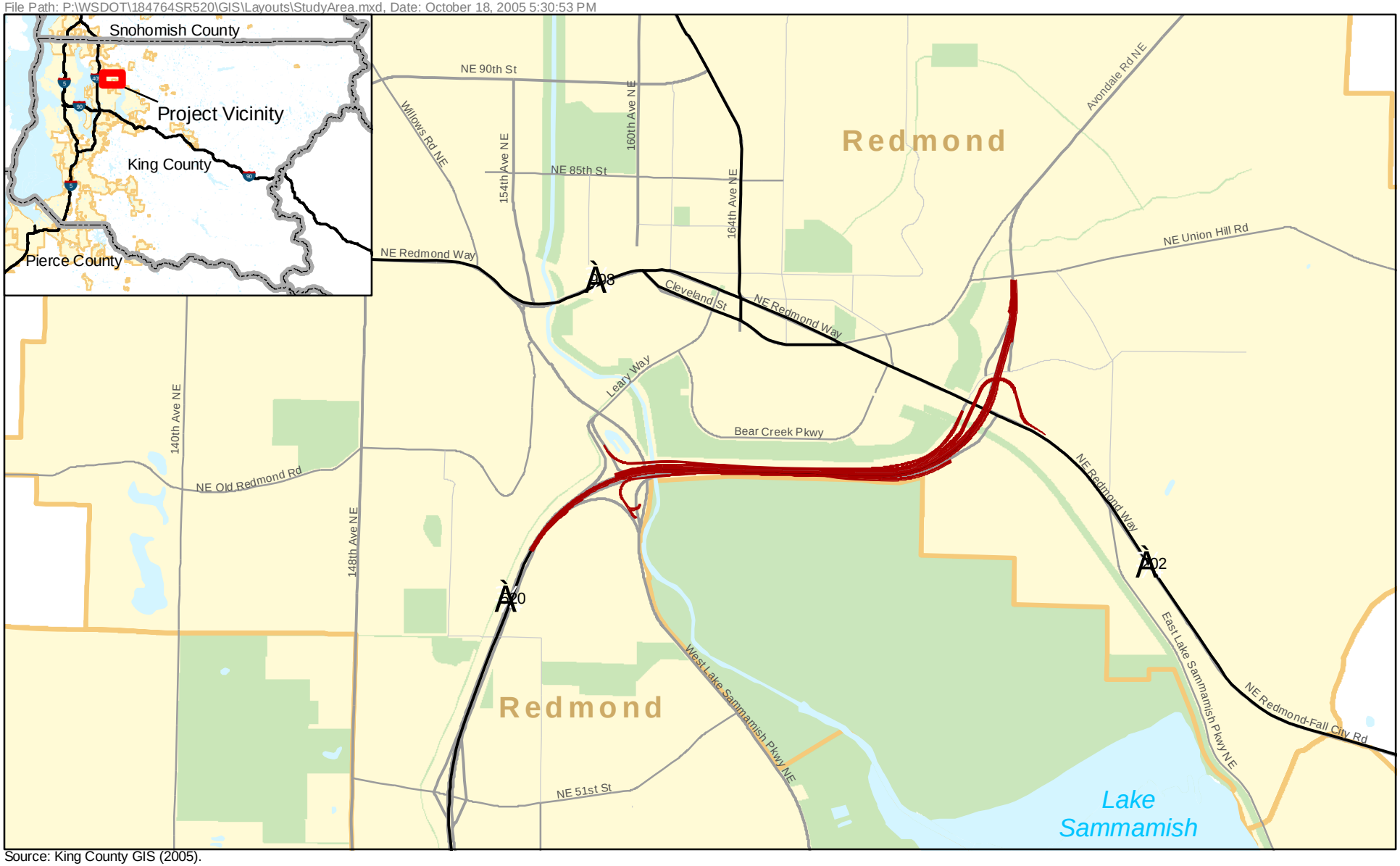


Source: King County GIS (2005).

Project Footprint (Edge of Pavement)
Parks
City

N

0 0.25 0.5 Miles

FIGURE 1
Study Area
SR 520/West Lake Sammamish Parkway to SR 202

The Build Alternative incorporates Stage Three of the Preferred Alternative outlined in the 1992 Final EIS. Figure 1 illustrates the proposed improvements. The improvements would:

- Add a carpool lane and an auxiliary lane in each direction of SR 520 at the West Lake Sammamish and SR 202 interchange areas. Additional bridges would allow three lanes of traffic (two general-purpose [GP] and one high-occupancy vehicle [HOV]) in each direction on SR 520 to access NE Union Hill Road, alleviating the current single-lane bottlenecks in each direction at SR 202.
- Construct a new flyover ramp connection from westbound SR 202 to westbound SR 520. The flyover would replace the westbound left-turn lanes on SR 202 at NE 76th Street, removing westbound left turns to SR 520 from the intersection and reconfiguring the intersection to accommodate the new layout. The two-lane flyover would have one lane designated for HOVs; the GP lane would be metered. In addition, during peak hours, a storage lane (12-foot storage plus a 2-foot shoulder) on the flyover would be used to serve as an additional GP lane to accommodate the projected demand in the future (this storage lane would be metered and used only during the peak hours).
- Complete improvements to the West Lake Sammamish interchange. The West Lake Sammamish interchange would be upgraded, with new ramp bridges over the Sammamish River and West Lake Sammamish Parkway.

Similar to the No-Action Alternative, the Build Alternative assumes all local and regional improvements.

Key Findings

- Congestion relief along SR 520 and SR 202 would be observed under the Build Alternative (when compared to the No-Action). Up to 6 minutes of travel time savings is estimated to occur along SR 520 (westbound direction, year 2010).
- Added capacity along SR 520 due to the Build Alternative would allow more vehicle throughput. For several areas along the SR 520 corridor, more than twice as many vehicles would use SR 520 under the Build Alternative (compared to the No-Action Alternative) in both future years.
- The proposed SR 202 flyover would improve travel times along SR 202 by over 10 minutes in the westbound direction.
- The proposed project would address the high accident rate at the eastbound SR 520 off-ramp to SR 202 by adding capacity in the area and realigning the ramp diverge, which would improve sight distance. Most accidents in this area are rear-end collisions related to congestion.
- No local arterial mitigation is warranted as a result of the Build Alternative because operations on local arterials are not negatively affected. In fact, the proposed project improves operations along the SR 202 corridor in the future.

Please note that the format of this report is intentionally similar to the 1992 Final EIS to allow ease of comparison between the two reports for the reader.

Review of the 1992 Final EIS and Previous Analysis

The 1992 Final EIS included widening the congested section of SR 520 from two GP lanes (one lane in each direction) to two GP lanes in each direction, plus an HOV lane. An add/drop lane was designated between the interchanges of West Lake Sammamish Parkway and SR 202.

The 1992 Final EIS included three stages of the project construction. Stage One has been completed and construction of Stage Two is underway. Stage One added an additional lane in each direction on SR 520 between Interstate 405 (I-405) and East Lake Sammamish Parkway. Other work included bicycle lanes, sidewalks, drainage, landscaped median, signing upgrades, signal revisions at the SR 520 off-ramp and at NE 70th Street. Stage Two includes improvements along SR 202 from East Lake Sammamish Parkway to Sahalee Way. The second stage includes two new lanes, retaining walls, noise walls, bicycle lanes, sidewalks, replacement of the bridges at 196th Avenue NE and at Evans Creek.

This project would complete Stage Three of the Preferred Alternative reviewed in the 1992 Final EIS by completing the HOV lane system on SR 520 through the study area, including auxiliary lanes at West Lake Sammamish Parkway and SR 202, along with the SR 202 flyover. The state's "Nickel Funding Package," approved by the Washington State Legislature, would provide the funding for Stage Three.

The following are some major differences between this analysis and the analysis performed for the 1992 Final EIS.

- **Design Year**

  The 1992 Final EIS assumed a design year of 2010. This updated report assumes an opening year of 2010 and a future design year of 2030; the traffic analysis reflects the new opening and design years.

- **HOV Lane**

  The 1992 Final EIS analyzed an HOV lane on SR 520 between West Lake Sammamish Parkway and SR 202, with no HOV lane between SR 202 and NE Union Hill Road. In contrast, the project analyzed in this report proposes continuous HOV lanes past the SR 202 interchange along eastbound SR 520. The 1992 Final EIS also assumed an HOV lane westbound on SR 202, which would access westbound SR 520 as a left turn at the signalized intersection. This report proposes that the HOV lane be placed on the proposed SR 202 flyover to allow for optimal HOV travel-time savings.

- **HOV Designation Change from 2+ to 3+**

  The HOV designation refers to the number of people required to be in a vehicle for it to qualify as an HOV and travel legally in the HOV lane. Currently, the HOV designation for this section of SR 520 is 2+, meaning 2 or more people. All scenarios analyzed in the 1992 Final EIS included 2+ occupancy for HOV lanes. In this report, traffic forecasts for 2030 assume that the HOV lanes would operate under 3+ rather than 2+ conditions; this assumption is consistent with other regional projects.

- **Lane Placement**

  WSDOT's long-range HOV system plan recommends that HOV lanes be placed on the inside lane of the corridor. Currently, the SR 520 HOV lanes are located on the outside. It is assumed that the catalyst for transitioning the HOV lanes to the inside would be another project along the SR 520 corridor. Given that the SR 520 West Lake Sammamish Parkway to SR 202 project has been funded through construction, it is assumed that the year of opening (2010) would contain outside HOV lanes and the 2030 design year would contain inside HOV lanes. The traffic analysis assumes the following:

  – Year 2010: Outside HOV lanes

  – Year 2030: Inside HOV lanes

- **Study Area**

  The study area is essentially the same for this study as it was for the 1992 Final EIS (see Figure 1).

- **Additional Signals**

  Since the original 1992 Final EIS was written, several signals have been added to the project area, including SR 202 and 170th Avenue, NE SR 202 and Bear Creek Crossing, SR 202 and NE 76th Street, and NE Union Hill and 178th Place. The addition of these signals has affected traffic patterns in the project vicinity.

- **Development: Redmond Town Center**

  The 1992 Final EIS described plans to develop the Redmond Town Center and Bear Creek Parkway. These plans have been realized, and this area has been extensively developed. In addition, the area along NE 76th Street, to the west side of SR 520 has also seen extensive commercial development. Development and new connections to the street grid have changed traffic patterns at the intersection on SR 520 with both SR 202 and NE Union Hill Road.

- **Mainline Changes**

  Since the 1992 Final EIS, the westbound HOV lane has expanded farther east near the West Lake Sammamish Parkway interchange (the 1992 Final EIS assumed that the HOV lane terminated at I-405). Just west of the project area, a new interchange, the 40th Street interchange, has been included.

- **Channelization**

  Channelization refers to the basic geometrics and lane line markings of a roadway, which includes the number and width of lanes, in addition to how those lanes are used (left-turn, right-turn, through). Channelization along several major roadways in the project area has changed since the 1992 Final EIS, including SR 202 and West Lake Sammamish Parkway. Other roadways have not changed according to the City of Redmond plans (Comprehensive Plan, Transportation Improvement Plan (City of Redmond, 2005), and Capital Investment Program (City of Redmond, 2005).

The project continues to be needed because the existing interchanges of SR 520 with West Lake Sammamish Parkway and SR 202 experience congestion resulting in long delays, which increases the potential for accidents. The project is designed to add capacity, relieve congestion, and improve safety. Capacity improvements include auxiliary lanes at the West Lake Sammamish Parkway and SR 202 interchanges along eastbound and westbound SR 520, a northbound to westbound flyover ramp from SR 202 to SR 520, and additional HOV lanes in both directions of SR 520 between West Lake Sammamish Parkway and east of SR 202.

Coordination Efforts

Regularly held Technical Advisory Committee (TAC) meetings were held and included WSDOT, City of Redmond, King County, and Sound Transit. Additionally, transit information was collected from both Sound Transit and King County Metro.

The project team (WSDOT and consultant team) worked with the City of Redmond to determine future projects in the study area. Baseline roadway geometry and traffic distribution conditions were based in part upon several City of Redmond documents, listed below:

- Transportation Improvement Program 2005-2010, City of Redmond (2005)
- Transportation Master Plan, City of Redmond (draft 01.05, adopted November 2005)
- Downtown Master Plan (2002), City of Redmond (*http://www.redmond.gov/ ConnectingRedmond/* policiesplans/dtpredmondway.asp)
- Capital Investment Program (CIP) 2005-2010, City of Redmond (2005) (*http://www.redmond.gov/* insidecityhall/publicworks/construction/construction.asp)

In addition, current plans for 2030 baseline geometric conditions at the intersections of SR 202 with 170th Avenue NE and Avondale Road Extension with NE Union Hill Road were provided by the City of Redmond.

Measures of Effectiveness

Three measures of effectiveness (MOEs) were used to evaluate and compare traffic operations between the No-Action and Build Alternatives. These measures were level of service (LOS), travel times, and throughput. These MOEs are described below.

Level of Service

LOS rates the quality of traffic operations on a given transportation facility. The rating scale uses the letters A through F, similar to grading scales used in the education system, where A is the best grade and F is a failing grade. The grades represent different conditions for different types of facilities. This section describes LOS for the three types of facilities included in this project: signalized intersections, freeway mainline sections, and freeway ramp sections.

Signalized Intersections

For signalized intersections, the letter grades representing LOS are based on the amount of delay that drivers experience at an intersection. The letter A represents the least-delayed conditions, while the letter F represents the most-delayed conditions. For intersections controlled by signals, LOS represents an average delay for the entire intersection. Please refer to Table 1 for the delay range associated for each LOS rating.

TABLE 1
Delay Ranges Associated with Signalized Intersection Level of Service Ratings

LOS	Conditions	Signalized Intersection Delay (sec/veh)
A	Best (very short delay)	≤ 10
B		> 10 and ≤ 20
C		> 20 and ≤ 35
D		> 35 and ≤ 55
E		> 55 and ≤ 80
F	Worst (very long delay)	> 80

Source: *Highway Capacity Manual* (TRB 2000)
sec/veh seconds per vehicle

Basic Freeway Segment

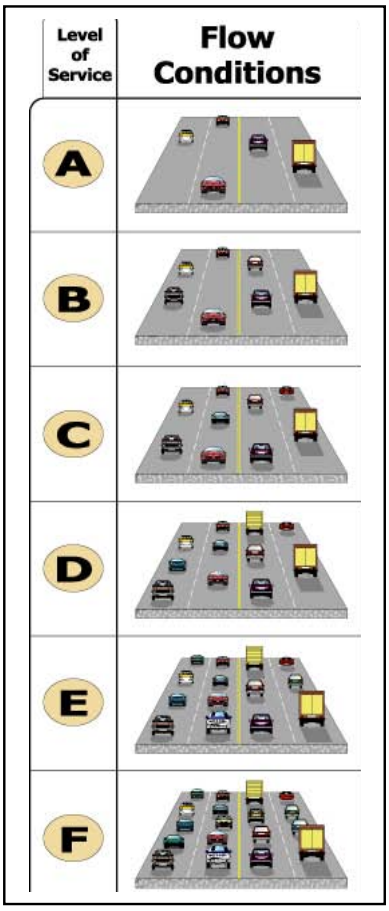
LOS for a basic freeway segment is based on density, or the number of passenger cars per mile per lane. Two other measures are important for characterizing freeway operations: speed in terms of mean passenger-car speed, and volume-to-capacity ratio. Each of these measures is an indication of how well traffic flow is being accommodated by the freeway. The three measures of density, speed, and volume-to-capacity are interrelated. LOS thresholds for a basic freeway segment are summarized in Table 2. Figure 2 illustrates traffic operations associated with each LOS rating for a basic freeway section.

TABLE 2
Density Ranges Associated with Freeway Segment Level of Service Ratings

LOS	Conditions	Density Range (pc/pm/pl)
A	Best (lowest density)	0-11
B		> 11 - 18
C		> 18 - 26
D		> 26 – 35
E		> 35 and ≤ 45
F	Worst (highest delay)	> 45

Source: *Highway Capacity Manual* (TRB 2000)
pc/pm/pl passenger car per mile per lane

FIGURE 2
Flow Conditions for LOS[1]



[1]LOS is a measure that describes vehicle speed and traffic operations
Source: *Highway Capacity Manual* (TRB 2004)

Ramp Areas (Merge and Diverge)

LOS in merge (and diverge) influence areas is determined by density for all cases of stable operation, represented by LOS A through E. LOS F exists when the total flow departing from the merge area exceeds the capacity of the downstream freeway segment. No density will be predicted for such cases. LOS criteria for merge and diverge areas are listed in Table 3. The density values shown for LOS A through LOS E assume stable traffic flow operation, with no breakdowns within the merge influence area.

The City of Redmond has set acceptable LOS for intersections within its boundaries. The City has delineated Transportation Management Districts, within which average intersection LOS must meet a certain standard. Study area intersections fall into several districts, as shown in Table 4.

TABLE 3
Density Ranges Associated with Ramp Level of Service Ratings

Level of Service	Conditions	Density Range (pc/pm/pl)
A	Best (lowest density)	<= 10
B		> 10 - 20
C		> 20 - 28
D		> 28 – 35
E		> 35
F	Worst (highest delay)	Demand exceeds capacity

Source: *Highway Capacity Manual* (TRB 2000)
pc/pm/pl passenger car per mile per lane

TABLE 4
City of Redmond Arterial Intersection Level of Service Standard

Transportation Management District	Study Area Intersections within the District	Average Level of Service Standard
Downtown	SR 202 and 170th Avenue NE	E+
	SR 202 and Bear Creek Crossing	
	SR 202 and NE 76th Street	
Southeast Redmond	SR 202 and SR 520 off-ramp (NE 76th Street)	D-
	SR 202 and NE 70th Street	
	SR 202 and 180th Avenue NE	
Northeast Redmond	Avondale Road NE and Avondale Road extension	D+
	Avondale Road extension and NE Union Hill Road	
	Avondale Way NE and NE Union Hill Road	
Viewpoint	West Lake Sammamish Parkway and eastbound SR 520 on- and off-ramp	D+
	West Lake Sammamish Parkway and westbound SR 520 on- and off-ramp	

Source: City of Redmond Comprehensive Plan, Map TR-1 and page 21 (2004).

The LOS standard set for each district is an average LOS for intersections within the district. Because this report only considers a few intersections from each area, it is not possible to determine whether the alternatives described in this report meet the City of Redmond LOS standards. Instead, the report compares individual intersections in order to quantify the effect of each alternative on LOS. The City of Redmond includes the addition of SR 520 HOV lanes and widening of the facility in the Transportation Facility Plan 1997-2012 (City of Redmond

Comprehensive Plan Table TR-5) as described in the Build Alternative, and has assumed that changes related to the Build Alternative would take place.

Although LOS is commonly used to describe the operations of different types of transportation facilities, these measures lack the ability to describe changes over an entire project area. In order to capture these changes on a larger scale, two other measures of effectiveness were used, travel time and vehicle throughput.

Travel Times

AM and PM peak hour travel times for routes in the study corridor are presented as a measure of an alternative's ability to efficiently provide mobility during periods of high use. Five travel routes were selected to represent the primary travel patterns in the study area. Travel times are reported for each route in both directions, for a total of ten travel time segments.

Vehicle (Corridor) Throughput

Measured throughput is a function of travel demand and congestion for a particular route. Given the demand for a travel route along a particular facility, throughput measures how many vehicles and people are actually getting through the area. Throughput is measured along the same routes as the travel time segments.

Affected Environment

Existing Conditions

This section describes the study area in its current condition, including GP and HOV vehicle operations, safety, transit, nonmotorized facilities, and transportation of freight by truck and rail.

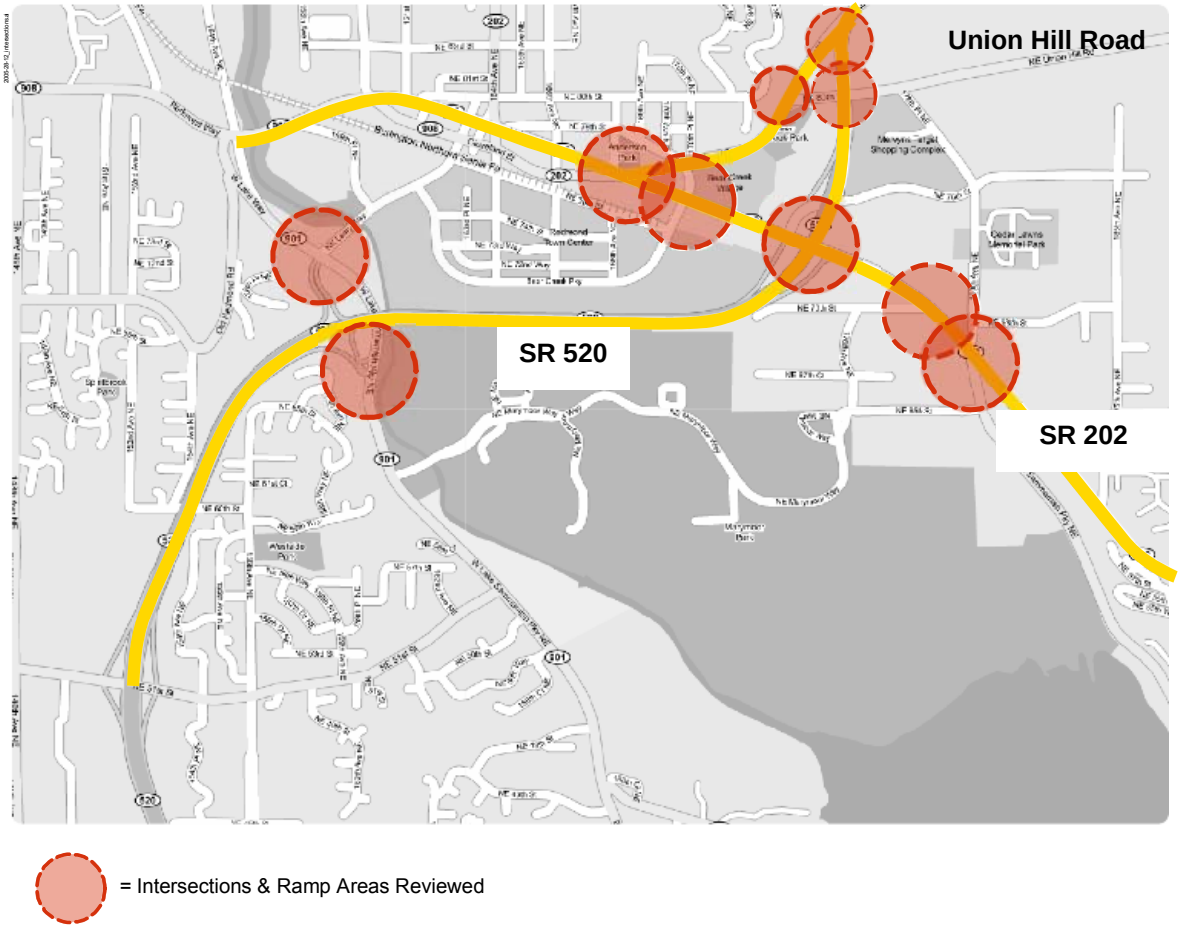
The study area follows SR 520 from west of the West Lake Sammamish Parkway interchange to east of SR 202, and SR 202 from west of SR 520 to west of 180th Avenue NE. The study area includes downtown Redmond, Avondale to NE Union Hill, and SR 202 to the eastern terminus. The signalized intersections that were evaluated are shown in Figure 3.

In addition to mainline freeway operations, the following intersections were analyzed as part of this study:

- SR 520 Ramps:
  - West Lake Sammamish Parkway NE Ramps
  - SR 202/Redmond Way Ramps
    - SR 520 eastbound Off Ramp
    - SR 520 westbound On-Ramp at NE 76th Street
- SR202/Redmond Way Intersections:
  - 180th Avenue NE / East Lake Sammamish Parkway
  - NE 70th Street

- 170th Avenue NE
- Bear Creek Crossing

FIGURE 3
Signalized Intersections in the Study Area



- Avondale Intersections:
  - Avondale Road Extension & Avondale Way NE
  - Avondale Road Extension & NE Union Hill Road
  - NE Union Hill Road & Avondale Way NE

Development of Existing Volumes

This section describes how existing SR 520 mainline and ramp volumes were developed and how the study area intersection volumes were derived.

Existing SR 520 Mainline and Ramp Volumes

Between the years 2002 and 2005, volumes in the Redmond area have stayed relatively the same. Along SR 520, mainline and ramp volumes were developed by referencing and using information from the following sources: manual traffic counts the team conducted in 2004 and 2005, WSDOT's ramp and roadway 2004 peak hour counts, 2002 Bear Creek Project study data,

and the City of Redmond's count data. The post-processed mainline and ramp volumes were then balanced throughout the study area.

HOV volumes were derived primarily from manual counts in 2004 and 2005 at various ramps and mainline locations. HOV travel mode share percentages were checked against 2004 ramp and roadway HOV volumes.

Table 5 shows existing (and future) volumes along the SR 520 corridor.

Existing Intersection Volumes

Existing year intersection volumes were developed based on manual traffic counts conducted in the study area and from the 2002 Bear Creek project study data. Appendix B illustrates the existing volumes at each intersection in the study area (along with channelization and LOS at the intersection).

TABLE 5
Peak Hour Traffic Volumes (GP and HOV Volumes Combined)

Eastbound SR 520: AM Peak Hour									
Alternative	**Mainline**	**West Lake Sammamish Parkway Off-Ramp**	**Mainline**	**West Lake Sammamish Parkway On-Ramp**	**Mainline**	**SR 202 Off-Ramp**	**Mainline**	**SR 202 On-Ramp**	**Avondale Road Extension**
Existing (2005 Counts)	2,690	695	**1,995**	275	2,270	1,000	1,270	50	1,320
2010 No-Action	2,780	715	2,065	300	2,365	1,035	1,330	55	1,385
2010 Build	2,795	720	2,075	300	2,375	1,040	1,335	55	1,390
2030 No-Action	3,350	970	2,380	405	2,785	1,400	1,385	75	1,460
2030 Build	3,425	980	2,445	405	2,850	1,415	1,435	75	1,510
Eastbound SR 520: PM Peak Hour									
Alternative	**Mainline**	**West Lake Sammamish Parkway Off-Ramp**	**Mainline**	**West Lake Sammamish Parkway On-Ramp**	**Mainline**	**SR 202 Off-Ramp**	**Mainline**	**SR 202 On-Ramp**	**Avondale Road Extension**
Existing (2004 ramp and roadway)	4,030	1,300	2,730	300	3,030	1,610	1,420	40	1,460
2010 No-Action	4,120	1,350	2,770	310	3,080	1,675	1,405	55	1,460
2010 Build	4,220	1,340	2,880	310	3,190	1,660	1,530	50	1,580
2030 No-Action	5,115	1,630	3,485	385	3,870	2,300	1,570	65	1,635
2030 Build	5,555	1,455	4,100	335	4,435	2,015	2,420	55	2,475

TABLE 5
Peak Hour Traffic Volumes (GP and HOV Volumes Combined)

Alternative	Avondale Road Extension	SR 202 Off-Ramp	Mainline	SR 202 On-Ramp	Mainline	West Lake Sammamish Parkway Off-Ramp	Mainline	West Lake Sammamish Parkway On-Ramp	Mainline
Westbound SR 520: AM Peak Hour									
Existing (2005 counts)	2,455	110	2,345	1,910	4,255	260	3,995	1,155	5,150
2010 No-Action	2,485	110	2,375	1,985	4,360	265	4,095	1,230	5,325
2010 Build	2,655	115	2,540	1,950	4,490	265	4,225	1,160	5,385
2030 No-Action	2,840	130	2,710	2,430	5,140	325	4,815	1,505	6,320
2030 Build	3,135	115	3,020	2,330	5,350	290	5,060	1,355	6,415
Westbound SR 520: PM Peak Hour									
Alternative	**Avondale Road Extension**	**SR 202 Off-Ramp**	**Mainline**	**SR 202 On-Ramp**	**Mainline**	**West Lake Sammamish Parkway Off-Ramp**	**Mainline**	**West Lake Sammamish Parkway On-Ramp**	**Mainline**
Existing (2004 ramp and roadway)	1,030	100	930	1,310	2,240	250	1,990	1,140	3,130
2010 No-Action	1,060	105	955	1,345	2,300	255	2,045	1,175	3,220
2010 Build	1,065	105	960	1,355	2,315	260	2,055	1,185	3,240
2030 No-Action	1,265	120	1,145	1,530	2,675	290	2,385	1,335	3,720
2030 Build	1,290	125	1,165	1,595	2,760	305	2,455	1,385	3,840

Existing Operational Conditions

Freeway Operations: SR 520 Mainline, Ramps, and Weaves

The existing operations for the mainline and ramp areas are presented in Tables 6 and 7 for eastbound and westbound SR 520, respectively.

In the eastbound direction, the area before the West Lake Sammamish Parkway Interchange experiences failing conditions in both the AM and PM peak hours. In addition, three areas experience failing operations in the PM peak hour, West Lake Sammamish Parkway interchange mainline, West Lake Sammamish Parkway merge, and the West Lake Sammamish

Parkway to SR 202 mainline. In the westbound direction, an LOS D is observed at the east end of the SR 520 corridor in the AM peak hour.

TABLE 6
Existing Eastbound SR 520 Mainline Level of Service

Travel Route	AM Peak Hour	PM Peak Hour
Before West Lake Sammamish Parkway	F	F
West Lake Sammamish Parkway off-ramp diverge	B	D
West Lake Sammamish Parkway interchange area mainline	B	F
West Lake Sammamish Parkway on-ramp merge	B	F
West Lake Sammamish Parkway on-ramp to SR 202 off-ramp	D	F
SR 202 off-ramp diverge	E	C
SR 202 off-ramp to NE Union Hill Road	F	C

TABLE 7
Existing Westbound SR 520 Mainline Level of Service

Travel Route	AM Peak Hour	PM Peak Hour
NE Union Hill Road to SR 202 off-ramp	D	B
SR 202 on-ramp merge	C	B
SR 202 on-ramp to West Lake Sammamish Parkway off-ramp (weave)	C	B
West Lake Sammamish Parkway off-ramp diverge	C	B
West Lake Sammamish Parkway interchange area mainline	B	B
West Lake Sammamish Parkway on-ramp merge	B	A
Past West Lake Sammamish Parkway on-ramp	B	B

Signalized Intersections

This section describes existing characteristics of intersections in the study area. Appendix B provides an illustration of intersection channelization, as well as intersection volumes and LOS. Existing AM and PM peak hour LOS for all project area intersections are shown in Table 8. Overall, under existing conditions, four project area intersections operate at LOS F in the AM peak hour; in the PM peak hour, three intersections operate at failing conditions. These intersections are described below.

TABLE 8
Signalized Intersection Level of Service and Delay: Existing Conditions

Intersection	AM Peak Hour	PM Peak Hour
SR 202 and Bear Creek Crossing	LOS A 10 s/veh	LOS B 18 s/veh
SR 202 and 170th Avenue North	LOS C 26 s/veh	LOS F 83 s/veh
SR 202 and NE 76th Street	LOS D 51 s/veh	LOS D 50 s/veh
SR 202 and SR 520 off-ramp	LOS E 70 s/veh	LOS E 66 s/veh
SR 202 and NE 70th Street	LOS D 37 s/veh	LOS C 24 s/veh
SR 202 and 180th Avenue NE	LOS F 81 s/veh	LOS F 83 s/veh
West Lake Sammamish Parkway and eastbound SR 520 on- and off-ramp	LOS B 12 s/veh	LOS C 26 s/veh
West Lake Sammamish Parkway and westbound SR 520 on- and off-ramp	LOS F 100 s/veh	LOS C 28 s/veh
Avondale Road NE and Avondale Road extension	LOS F 149 s/veh	LOS B 13 s/veh
Avondale Road extension and NE Union Hill Road	LOS F 140 s/veh	LOS F 98 s/veh
Avondale Way NE and NE Union Hill Road	LOS D 45 s/veh	LOS C 21 s/veh

s/veh seconds per vehicle

SR 202 and 170th Avenue NE

This signalized intersection provides access from SR 202 to the Redmond Town Center and Bear Creek Village. The intersection operates at LOS C in the AM peak hour and LOS F in the PM peak hour.

SR 202 and Bear Creek Crossing

This intersection has been recently signalized and serves adjacent shopping centers for vehicles on SR 202. Although through traffic volumes on SR 202 are high, traffic volume accessing SR 202 from Bear Creek Crossing is low, allowing a majority of the green time to be allocated to the SR 202 movements. This intersection operates at an LOS A in the AM peak hour and LOS B in the PM peak hour.

SR 202 and NE 76th Street

This intersection is a major access point to westbound SR 520 for vehicles coming from Redmond and the Sammamish Plateau. The high number of vehicles turning left (1,325 vehicles in the AM peak hour and 900 in the PM peak hour) off westbound SR 202 to access SR 520 must compete for green signal time with the trough traffic on SR 202 and southbound traffic on NE

76th Street. These high volumes on conflicting movements result in LOS D operations in the AM and PM peak hours.

SR 202 and SR 520 Off-Ramp

This signalized intersection connects eastbound SR 520 to SR 202. Heavy volumes traverse this intersection along SR 202 as well as the volume exiting SR 520. Under existing conditions, the intersection operates at LOS E in the AM and PM peak hours. During the PM peak hour, the intersection operates at LOS E because of inadequate capacity on the northbound approach and the eastbound right movement. The left-turn movement coming off the SR 520 ramp is near capacity.

SR 202 and NE 70th Street

NE 70th Street serves an industrial area and office park adjacent to Marymoor Park. The intersection operates at LOS D in the AM peak hour and LOS C in the PM peak hour. Eastbound SR 202 is overcapacity in the PM peak hour, but all other approaches have remaining capacity. This intersection is under construction as part of a widening project. Existing conditions were modeled using pre-construction geometric configuration and volumes.

SR 202 and 180th Avenue NE

This intersection connects 180th Avenue NE to SR 202 and works in tandem with the intersection to the east to access East Lake Sammamish Parkway. Vehicles can access East Lake Sammamish Parkway through this intersection and exit East Lake Sammamish Parkway through the adjacent intersection to the east. The signal operations for the two intersections are clustered, which means they share a signal controller to better coordinate the traffic movements and signal timing. During the AM and PM peak hours, this intersection operates at failing conditions. Contributing factors to the failing condition include the eastbound SR 202 approach (which is overcapacity) in the AM peak hour and the southbound approach and the eastbound left and through movements are overcapacity during the PM peak hour. This intersection is under construction as part of a widening project. Existing conditions were modeled using pre-construction geometric configuration and volumes.

Avondale Road NE and Avondale Road Extension

This intersection carries a heavy directional flow southbound in the AM peak hour and northbound in the PM peak hour. High volumes northeast-bound and southwest-bound must compete for signal green time with traffic exiting SR 520 from the south. The intersection operates at LOS F in the AM peak hour and LOS B in the PM peak hour.

Avondale Road Extension and NE Union Hill Road

This intersection carries a heavy directional flow southbound in the AM peak hour (LOS F) and northbound in the PM peak hour (LOS F). It operates in coordination with Avondale Road NE/Avondale Road Extension and Avondale Way NE/NE Union Hill Road.

Avondale Way NE, Avondale Road NE, and NE Union Hill Road

This intersection connects vehicles traveling from SR 202 to the east via NE Union Hill Road and Avondale Way NE. On the south side of the intersection, Avondale Way NE carries two lanes in both directions; on the north side, Avondale Road NE has one lane in each direction. There is a northbound right-turn drop lane. Westbound vehicles must turn left, using a double

left-turn lane. Under existing conditions, vehicle demand is balanced in the AM peak hour. In the PM peak hour, demand is slightly higher from the south than from the north or west. The intersection operates at LOS D in the AM peak hour and LOS C the PM peak hour.

West Lake Sammamish Parkway, NE Leary Way, and SR 520 Westbound Ramps

This heavily utilized intersection serves SR 520 and provides access to Redmond Town Center, Downtown Redmond, and Marymoor Park. The City of Redmond recently completed an expansion project along the West Lake Sammamish Parkway. The intersection operates at LOS F in the AM peak hour and LOS C in the PM peak hour.

West Lake Sammamish Parkway and SR 520 Eastbound Ramps

This intersection provides access to SR 520, Redmond Town Center, Downtown Redmond, and Marymoor Park. During the PM peak hour, this intersection accommodates nearly 74 percent more vehicles than in the AM peak hour. The intersection operates at LOS B in the AM peak hour and LOS C the PM peak hour.

Travel Times

Table 9 describes the travel times for various routes under existing conditions.

TABLE 9
Existing Corridor Travel Times[1]

Travel Route Description	AM Peak Hour	PM Peak Hour
SR 520 eastbound: general purpose lanes from before West Lake Sammamish Parkway to the Avondale Road and NE Union Hill Road intersection	3	5
SR 520 eastbound: HOV lane from before West Lake Sammamish Parkway to the Avondale Road and NE Union Hill Road Intersection	3	5
SR 520 westbound: general purpose lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	9	3
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	9	3
NE Union Hill Road (east of Avondale Road) to SR 520 westbound west of West Lake Sammamish Parkway (general purpose)	5	7
NE Union Hill Road (east of Avondale Road) to SR 520 westbound west of West Lake Sammamish Parkway (HOV)	5	7
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 westbound west of West Lake Sammamish Parkway (general purpose)	7	6
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 westbound west of West Lake Sammamish Parkway (HOV)	7	6
SR 202 westbound (east of East Lake Sammamish Parkway) through past NE 170th Avenue NE (general purpose)	6	4
SR 202 eastbound (west of NE 170th Avenue NE) through past east Lake Sammamish Parkway (general purpose)	4	6

[1]Travel times are expressed in minutes

Accident and Safety Analysis

This section reviews collisions that have occurred in major roadways and intersections in the vicinity of the SR 520 and the SR 202 interchange. Collision information was received from WSDOT for years 2001, 2002, and 2003 at four major mainline and interchange/intersection locations:

- **SR 520** between the 51st Street interchange and SR 202 (Redmond Way)
- **SR 202** (Redmond Way and SR 908) between Sahalee Way NE and West Lake Sammamish Parkway NE
- **Avondale Road Extension** between SR 202 and Avondale Road NE
- **Avondale Way NE** between Avondale Road NE and SR 202

High accident location (HAL) and high accident corridor (HAC) reports were also received from WSDOT for locations within the study corridor (WSDOT Collision Data and Analysis Branch, 2005).

Safety Data

A total of 898 collision record summaries were received and reviewed (between 2001 and 2003). None of those accidents were fatal, but 352 (39.2 percent) resulted in injuries. The total number of collisions and injury collisions decreased over this time period, with 25 fewer collisions, and 23 fewer injury collisions in 2003 than 2001, as shown in Table 10.

TABLE 10
Collision Summary

	Year	Total Collisions	Injury Collisions	Fatal Collisions
SR 520	2001	94	43	0
	2002	84	35	0
	2003	69	21	0
	Subtotal	247	99	0
SR 202 (Redmond Way and SR 908)	2001	205	79	0
	2002	190	65	0
	2003	194	79	0
	Subtotal	589	223	0
Avondale Road Extension	2001	7	7	0
	2002	17	8	0
	2003	15	8	0
	Subtotal	39	23	0

TABLE 10
Collision Summary

	Year	Total Collisions	Injury Collisions	Fatal Collisions
Avondale Way NE	2001	5	3	0
	2002	10	3	0
	2003	8	1	0
	Subtotal	23	7	0
Total	2001	311	132	0
	2002	301	111	0
	2003	286	109	0
	GRAND TOTAL	**898**	**352**	**0**

The predominant collision type cited was rear-end (53 percent). Rear-end collisions are most commonly associated with congested traffic operations. The next most frequent accident types were striking at an angle (10 percent), striking a fixed object (7 percent), and opposing direction collisions (6 percent).

WSDOT identifies locations where accidents are greater in number and severity during the previous 4 years as compared to similar routes. These are compiled into high accident location (HAL) and high accident corridor (HAC) reports (WSDOT Collision Data and Analysis Branch, 2005). A HAL is generally less than one-quarter mile long, and a HAC is generally more than a mile long. There are no HACs in the study area. The sole HAL within the study area is the eastbound SR 520 off-ramp to SR 202, from milepost 0.10 to 0.43 (from the gore to the intersection). As shown in Table 10, this ramp had an accident rate of 5.8 per million vehicle miles, which is much higher than average for King County. According to the 1996 Washington State Highway Annual Collision Data Summary (most recent available http://www.wsdot.wa.gov/mapsdata/tdo/PDF_and_ZIP_Files/StateHwyAccidentRpt.pdf), the average accident rate for a state highway in an urban area was 2.24. Between January 2003 and December 2004, over 85 percent of the accidents were related to the right-turns on red at the ramp intersection.

The majority of accidents were related to congestion at ramp intersections (rear-ends, free right turns at intersection). As shown in Table 10, when intersection-related accidents are removed from the calculation, the rate drops to 1.5 per million vehicle miles.

There are no high accident locations or high accident corridors reported on the other roadways within the limits of the study area.

The following section details the safety conditions on SR 520 mainline and ramps, and at major intersections in the study area.

SR 520 Ramp Areas

During the 3-year period reviewed, 76 accidents occurred on SR 520 ramp areas in the study area. Table 11 compares accident rates on the study area on- and off-ramps serving westbound SR 520. The accident rate was obtained by applying the following formula:

(Number of accidents x 1,000,000) /
(average annual daily traffic x segment length x 365)

This gives the number of accidents per million vehicle miles.

TABLE 11
Accident Rates on SR 520 Ramps

Ramp	Number of Accidents	Accident Rate per Million Vehicle Miles	
		(Ramp + Intersection)	(Ramp Only)
Westbound off-ramp to West Lake Sammamish Parkway	0	0	0
Westbound on-ramp from West Lake Sammamish Parkway	5	1.2	1.0
Westbound on-ramp from SR 202	10	2.2	0.6
Eastbound off-ramp to West Lake Sammamish Parkway	12	2.4	1.7
Eastbound off-ramp to SR 202	45	5.8	1.5

The last column in Table 11 shows the ramp accident rate excluding the intersection. This column was provided to illustrate how most accidents are related to intersection operations rather than ramp design issues. Accident rates on the ramps are generally much lower when intersection accidents are discounted, though several ramps still have a rate above one.

The eastbound off-ramp from SR 520 to SR 202 has substantially more accidents (45) than any of the other ramps. SR 520 terminates at SR 202; the high number of accidents at this location can be attributed to slowing traffic and congestion caused by the transition from highway to arterial street. This assessment is also supported by the high percentage of rear-end collisions (43 of the 45 collisions). A high volume of traffic forced to greatly reduce travel speeds causes congestion and induces a high number of rear-end collisions Merge and weave movements at ramp areas often cause side-swipe accidents, which explains the high percentage of side-swipes at these locations (39 percent).

SR 520 Mainline

For purposes of the safety analysis, the SR 520 mainline was divided into four segments, including eastbound and westbound segments between 51st Street and West Lake Sammamish Parkway, and West Lake Sammamish Parkway and SR 202. The main line segments between ramp areas on SR 520 were relatively short, ranging from a tenth to a half of a mile. The number of accidents per million vehicle miles was calculated to provide a better comparison between

accidents in the different segments. Mainline accident rates were calculated using the same formula as the ramp rate calculations.

Accident rates on SR 520 within the study area are shown in Table 12. Eastbound SR 520 experiences higher accident rates than westbound SR 520 for the same reasons that the rate is much higher in the eastbound ramp areas. SR 520 terminates at SR 202 in the eastbound direction and is just starting in the westbound direction. This geometric configuration results in more congestion and a high number of rear-end collisions eastbound.

TABLE 12
Collision Summary

SR 520 Mainline Segment	Number of Collisions	Segment Length (miles)	Annual Average Daily Traffic	Accident Rate
Westbound				
SR 520 mainline between 51st Street and West Lake Sammamish Parkway	1	0.09	100,000	0.30
SR 520 mainline between West Lake Sammamish Parkway and SR 202	5	0.48	78,640	0.36
Eastbound				
SR 520 mainline between 51st Street and West Lake Sammamish Parkway	11	0.21	100,000	1.44
SR 520 mainline between West Lake Sammamish Parkway and SR 202	28	0.54	78,640	1.81

Safety at Arterial Intersections

Accident data for intersections in the study area were collected from WSDOT and the City of Redmond. Table 13 illustrates the number of accidents and the accident rates (the accident rates are shown as accidents per million vehicles entering the intersection). The formula used for calculating rates was:

(Number of accidents x 1,000,000) / (daily traffic x 365)

Daily traffic is an estimate of the number of vehicles entering the intersection in a typical day. Accidents occurring within 0.06 miles of the intersection were considered to be related to intersection traffic movements.

From Table 13, it is evident that the intersection of the SR 520 eastbound off-ramp with SR 202 had the highest number of accidents and the worst accident rate of major study area intersections. It is followed in severity by the SR 520 westbound on-ramp at SR 202. Rear-end accidents made up a majority of the accidents at the ramp intersections. These can be attributed to reduced travel speeds, congested conditions, and long queues. Entering-at-angle accidents were also prevalent, likely due to vehicles turning into traffic during the all-red period to avoid waiting until the next green light. Both rear-end and entering-at-angle accidents were also

prevalent at the intersections of Avondale Road NE with Avondale Way NE and NE Union Hill Road.

TABLE 13
Accident Rates at Major Intersections

Intersection	Number of Accidents	Accident Rate per Million Entering Vehicles
SR 520 westbound ramps at West Lake Sammamish Parkway	14	0.9
SR 520 westbound ramp at SR 202 and NE 76th Street	32	2.0
SR 520 eastbound ramps at West Lake Sammamish Parkway and Leary Way	10	0.5
SR 520 eastbound ramp at SR 202	53	3.2
Avondale Road NE at Avondale Way NE	13	0.9
Avondale Road Extension at NE Union Hill Road	8	0.7

During the 3-year period analyzed, three accidents in the project area involved bicycles and one involved a pedestrian. The three bicycle accidents all resulted in evident but not disabling injuries, while the pedestrian accident did not result in injury. Two of the bicycle accidents took place at the intersection of SR 520 westbound ramps with SR 202 and Leary Way. Both accidents were due to right-turning traffic hitting a bicycle that was traveling straight through the intersection. The other bicycle accident and the pedestrian accident both occurred half-way up the SR 520 eastbound off-ramp, some distance from the intersection. From the accident reports, it appears that the bicyclist and pedestrian were crossing the ramp near the rail right-of-way.

Transit and HOVs

Transit Service

Transit service in the study area is provided by King County Metro, Community Transit (Snohomish County), and Sound Transit. Nine routes operate during peak hours only, with another ten providing service during midday hours. Peak-hour buses have an average headway of approximately 30 minutes. Hours of operation on non-peak-hour routes are generally from 6 a.m. to 8 p.m., with four routes offering late-night service. Nine routes provide weekend service. Routes passing through the study area connect Redmond with:

- Downtown Seattle (216, 250, 265, 266, 268, 540, 545)
- Bellevue (220, 233, 245, 249, 250, 253, 268, 269)
- Kirkland and Bothell (220, 245, 251, 254, 540)
- Duvall (232)
- Issaquah (269)

- Kent and Renton (247, 564, 565)
- Edmonds (441)
- North Bend and Snoqualmie (929)

There are two park-and-ride lots (Redmond and Bear Creek) in the vicinity of the project. The Redmond Park-and-Ride provides 344 parking stalls, and the Bear Creek lot provides 334. The Redmond lot was at 97 percent capacity on an average weekday in the fourth quarter of 2004, while the Bear Creek lot was at 61 percent capacity. Thirteen transit routes serve the Redmond Park-and-Ride, and eleven serve Bear Creek.

Six transit routes operate on SR 520 in the project area: 230, 232, 233, 268, 269, and 545. Route 268 provides peak hour service and 545 provides all-day express service between Redmond and downtown Seattle via SR 520. Route 269 operates during peak periods only between Issaquah and Redmond via the Sammamish Plateau. Route 233 connects downtown Bellevue with Redmond, while route 232 continues to Duvall. Both operate between 6 a.m. and 8 p.m.

The *King County Metro Six-Year Plan* (2001-2007) sets objectives and strategies for transit, paratransit, rideshare services, and supporting capital facilities in King County. Mobility investments emphasize improvements in frequencies and increased span of service in areas of King County with transit-supportive land-use and higher ridership potential. Several initiatives proposed as part of the *Six-Year Plan* affect the study area:

- Consolidate service on SR 520 to mitigate the inconvenience of transfers, provide sufficient capacity on the main segment of routes, and shift to a headway-based system (or more evenly spaced trips throughout the day).
- Improve service frequencies between downtown Seattle and Redmond.
- Explore the potential for bus rapid transit (BRT) between downtown Redmond, Overlake, and Bellevue via NE 8th Street, 156th Avenue NE, and SR 520.

Sound Move, Sound Transit's current 10-year plan, does not contain improvements that would significantly affect transit in the study area. However, Sound Transit's 2006-2016 10-year plan is under development and may contain the following projects that could affect transit in the study area:

- Construct a fixed guideway line (light rail or rail convertible BRT) with access stations and park-and-ride lots from Overlake to Redmond.
- Sound Transit's Phase 2 planning study recommends High-Capacity Transit (HCT) service for the SR 520 corridor as a potential project.

HOVs

HOVs in the study area are comprised primarily of carpools and vanpools. Within the study area, HOV lanes are not on SR 520 and therefore limited benefits are available to HOVs. West of the study area, HOV lanes are present along SR 520.

Nonmotorized

Nonmotorized transportation modes consist of bicycles, pedestrians, and equestrians. The existing roadways in the vicinity of SR 520 affect nonmotorized travel patterns. Within the project area, nonmotorized activity is light given the high traffic volumes and large intersection footprints (especially along SR 202), creating an environment not particularly conducive to nonmotorized traffic. However, the area's development pattern contributes to significant pedestrian and bicycle activity in the general vicinity of the project.

Bicycles

Bicycling is important to the character of the Redmond community. The city's nickname is the "Bicycle Capital of the Northwest" (http://www.redmond.gov/aboutredmond/aboutredmond.asp). Bicycle routes in the project vicinity are shown in Figure 4. Marymoor Park, located on the east side of the SR 520 off-ramp intersection with West Lake Sammamish Parkway, has a velodrome that is a popular venue for bicycle events. It is used as a starting point for bicycle tours and is also the southern terminus of the Sammamish River Trail. This major transportation and recreational facility of nonmotorized transportation begins in Kenmore, travels through Bothell, and continues parallel to the Sammamish River into Bellevue.

The Bear Creek Trail parallels Bear Creek, located between Bear Creek Parkway and SR 520, and connects to the Sammamish River Trail north of the Leary Way intersection with West Lake Sammamish Parkway. This trail is proposed to continue northward after crossing SR 202 on the west side of SR 520.

SR 202 between Redmond and Fall City, Avondale Road NE, and NE Union Hill Road are all popular bicycle touring routes. Along SR 202, several trails are proposed to connect with the existing Interim East Lake Sammamish Trail, which runs along the south side of SR 202 between the SR 520 northbound off-ramp and 180th Avenue NE. The Burlington-Northern Railroad (BNSF) right-of-way, which extends to either side of the interim trail, is planned as a multi-use trail and Class I bikeway. King County is currently in negotiations with BNSF to purchase this right-of-way for a trail.

Sidewalks or mixed-use trails are available along all arterials in the study area. Bicycle lanes are in place along West Lake Sammamish Parkway, which is a City of Redmond Class II bikeway (City of Redmond Comprehensive Plan Map TR-5, undated). . SR 202 in the study area is a City of Redmond Class III bikeway west of Bear Creek Road, while NE 76th Street is a Class I bikeway between SR 202 and SR 520 (*Ibid*). Bicycle lanes are also proposed to parallel the SR 520 on- and off- ramps between NE 76th Street and NE Union Hill Road. These would connect with existing bike lanes on NE Union Hill Road east of the intersection with Avondale Road Extension.

Pedestrians

Pedestrian facilities in the study area include the trails described above and sidewalks. The only study area intersection without sidewalks is the SR 520 northbound off-ramp intersection with West Lake Sammamish Parkway. Pedestrians in this vicinity are served by the West Lake Sammamish Trail, which runs parallel to West Lake Sammamish Parkway. Existing and proposed grade-separated trails in the study area are shown on Figure 4.

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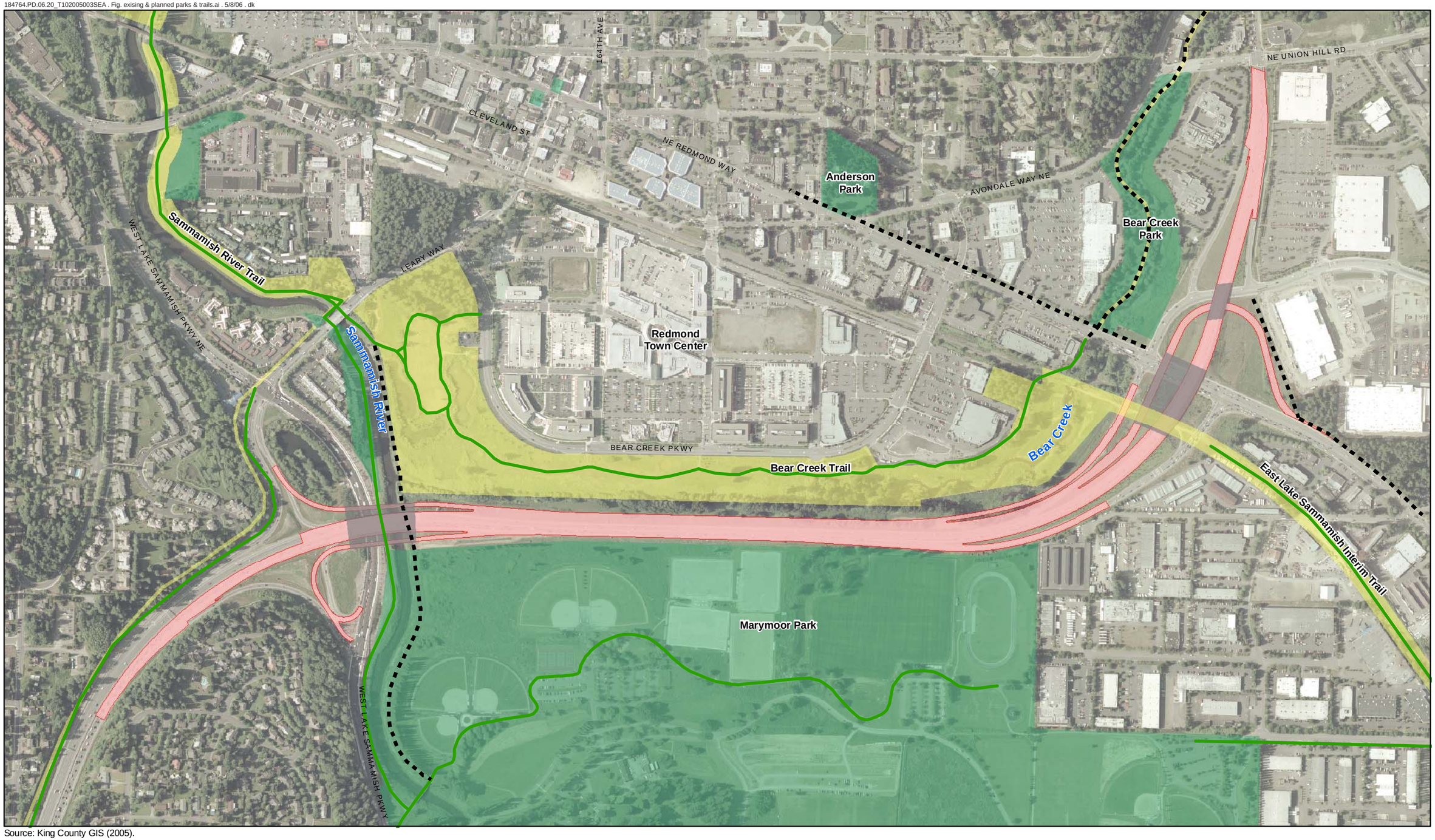

Source: King County GIS (2005).

Proposed Trail
Existing Trail
Park
Trail ROW
Project Footprint (Edge of Pavement)
Bridge

N

0 500 1,000
Approximate scale in feet

FIGURE 4

Existing and Planned Parks and Trails

SR 520/West Lake Sammamish Parkway to SR 202

File Path: P:\WSDOT\184764SR520\GIS\Layouts\ParksTrails.mxd

Equestrians

Multiple trail facilities in the project vicinity serve equestrians. The Bridal Crest Trail equestrian path runs between Marymoor Park and Bridle Trails State Park. The trail begins at Bridle Trails State Park, ending near the main entrance to Marymoor Park. Another trail used by equestrians is the West Lake Sammamish Trail. It follows the Sammamish River on the east side of West Lake Sammamish Parkway, as shown in Figure 4. The East Lake Sammamish Trail, which is proposed for completion on the south side of SR 202 in the BNSF right-of-way, would serve equestrians as well as pedestrians and bicyclists. Completion of the trail crossing under SR 520 at SR 202 is included as part of this project as shown in Figure 4.

Truck and Rail Freight

Trucks

Trucks on SR 520 were counted at the SR 202 and NE Union Hill Road ramps in May 2005 during both the AM and PM peak periods. The results are shown in Table 14.

TABLE 14
Truck Percentages at Study Area Intersections

Location	Peak Period	Truck Percentage
SR 520 on-ramp at SR 202	AM	8.2
Avondale Extension (SR 520) at NE Union Hill Road	AM	3.8
SR 520 off-ramp at SR 202	PM	3.0
Avondale Extension (SR 520) at NE Union Hill Road	PM	3.3

There is a UPS delivery facility near the NE Union Hill Road and Avondale Way NE intersection. UPS is a package delivery service that uses small- to medium-size trucks to make daily deliveries. The facility contributes to truck volumes on the SR 520 corridor in the study area.

Railroads

A Burlington Northern Santa Fe (BNSF) rail track parallels SR 202 on the south side, crossing SR 520 approximately 300 feet south of the SR 520/SR 202 intersection. At this time, BNSF no longer operates trains on the track, and is in negotiations with King County to sell the right-of-way.

Future Operational Conditions for the No-Action and Build Alternatives

This section details the alternatives analyzed and the results of the transportation analysis. The alternatives are compared based on MOEs such as LOS, travel speeds, travel times, and

throughput. The analysis was conducted using the future opening year 2010 and design year 2030.

Alternatives Analyzed

The alternative description has been included in this section to aid in the comparison of results between alternatives. Two alternatives were analyzed: 1) No-Action and 2) Build. The alternatives are described in detail below.

The No-Action Alternative assesses future roadway operations conditions if the proposed project were not built. The No-Action Alternative provides the basis for measuring and comparing the project's Build Alternative. All other anticipated changes to the land use and roadways anticipated to be complete before 2030 are included as part of the No-Action Alternative (see Analysis Methodology section). It is assumed that ongoing WSDOT roadway maintenance would occur.

The Build Alternative implements Stage Three of the Preferred Alternative outlined in WSDOT's 1992 Final EIS. The improvements include:

- Add a carpool lane and an add/drop lane in each direction of SR 520. Additional bridges would allow three lanes of traffic (two GP and one HOV) in each direction on SR 520 to access NE Union Hill Road, eliminating the current single lane bottlenecks in each direction at SR 202.
- Construct a new flyover ramp connection from westbound SR 202 to westbound SR 520. The flyover would replace the westbound left-turn lanes on SR 202 at NE 76th Street, removing westbound left turns to SR 520 from the intersection and reconfiguring the intersection to accommodate the new layout.
- Complete improvements to the West Lake Sammamish interchange. The West Lake Sammamish interchange would be upgraded, with new ramp bridges over the Sammamish River and West Lake Sammamish Parkway.

Similar to the No-Action Alternative, the Build Alternative assumes all local and regional improvements expected to be in place by 2030.

Development of Future Year (2010 and 2030) Volumes

A transportation demand model (Puget Sound Regional Council [PSRC]) was used to estimate future volumes for 2010 and 2030 peak hours. Changes in modeled volumes between future alternatives resulted from changes in the ability of the transportation network to accommodate demand for roadway capacity.

Model Development

The travel forecast modeling work built off of the modeling done for the SR 520 HOV and Bridge Replacement (SR 520 HOV&BR) Project and earlier stages of this project. WSDOT, King County Metro, and the City of Redmond agreed that the travel model developed for the SR 520 HOV&BR Project would be used to perform travel forecasting analysis for both Year 2010 and Year 2030. The 6 Lane Tolled (6LT) alternative would be used for 2030 because it most closely

resembles the preferred alternative recommended from the *Translake Washington Study* (WSDOT 2002). The model developed for the SR 520 BR&HOV Study was based on the PSRC model, with some refinements to produce more accurate forecasts within the study corridor.

The following model runs were developed for this report:

- 2010 No-Action and 2010 Build
- 2030 No-Action and 2030 Build

To determine what improvements should be incorporated into the future No-Action and Build models, several references were used:

- Nickel Funding Package (where applicable) http://www.wsdot.wa.gov/Projects/Funding/Nickel/
- SR 520 HOV&BR Project 6LT alternative Year 2030 Model (based on PSRC's Year 2030 Model) (http://www.wsdot.wa.gov/Projects/SR520Bridge/)
- Central LINK Light Rail (http://www.soundtransit.org/projects/svc/link/)
- Commuter Rail (http://www.soundtransit.org/projects/svc/sounder/)
- Redmond's Transportation Improvement Program, 2005 – 2010, City of Redmond
- Redmond's Transportation Master Plan, City of Redmond (draft January 2005)
- Redmond's Downtown Master Plan - concepts, few transportation recommendations (http://www.redmond.gov/ConnectingRedmond/policiesplans/dtpredmondway.asp)
- Redmond's Capital Investment Program (CIP), City of Redmond 2004 (http://www.redmond.gov/insidecityhall/publicworks/construction/construction.asp)
- King County CIP

Future Roadway Improvements Included in the Model

Table 15 summarizes which future regional projects are assumed completed for the 2010 and 2030 models (No-Action and Build). Table 16 summarizes the City of Redmond's planned improvement projects along with the anticipated year the project would be in place (year 2010 or 2030). Only those projects that have completed the planning phase and are at least partially funded were included.

Analysis Methodology

Both freeway and local street operations were analyzed as part of this study using VISSIM software. VISSIM is a software tool that simulates traffic operations on freeway and arterial facilities and was used to analyze mainline and intersection traffic operations in the study corridor. VISSIM uses a modeled network based on existing configuration data (number of lanes, segment length, ramp locations, free-flow speeds, etc.). The software estimated peak hour speeds, throughput, travel times, mainline LOS, intersection LOS, and intersection delay in both

the AM and PM peak period for the future alternatives (2010 No-Action, 2010 Build, 2030 No-Action, and 2030 Build).

Intersection operations were initially modeled using Synchro (Version 6.0) software. Synchro is a macroscopic analysis modeling tool that reports intersection delays and the corresponding LOS after the user specifies parameters such as traffic volumes, lane configurations, and signal timing. Synchro has the function of optimizing the intersection cycle lengths and phases that can then be incorporated into the VISSIM model. Combining both mainline and intersection operations in one model has the ability to account for overall traffic operations and impacts the mainline and intersection operations have on one another.

TABLE 15
Regional Projects Assumed Complete for Future-Year Modeling

2010	2030
Addition of an auxiliary lane from West Lake Sammamish Parkway to SR 202 (eastbound and westbound) along SR 520	HOV&BR 6LT alternative in place
Construction of a two-lane flyover ramp from westbound SR 202 to westbound SR 520, with no HOV lane designation	All Nickel Funding Package-funded projects assumed (proposed SR 520 West Lake Sammamish Parkway to SR 202 project improvements removed from 2030 baseline model)
HOV lane incorporation along SR 520 within project study area	Sound Transit Central LINK Light Rail: Northgate to South 200th Street
Nickel Funding Package (only those projects assumed to be in place by year 2010 would be included)	Sound Transit Commuter Rail: Everett to Lakewood
Sound Transit LINK Rail: Downtown Seattle to the Seattle-Tacoma International Airport	
Sound Transit Commuter Rail: Everett to Lakewood	

HOV&BR 6LT SR 520 HOV and Bridge Replacement Project and 6-Lane Tolled Alternative

TABLE 16
City Of Redmond's Planned Project Improvements

Project Number	Street	Limits	Description	Comments	Year of Opening (in-place)	Funded	Programs
1	Bear Creek Parkway	Leary Way to 170th Place NE (Redmond Way east)	Widen from 3 to 4 lanes	Modeling, Synchro	2030	No	TMP, Build Out, TIP
2	Bear Creek Parkway	Leary Way to Redmond Way	Construct new roadway	Modeling, Synchro	2030	Partial	TMP, Build Out
3	West Lake Sammamish Parkway	Bel-Red Road to NE 51st Street	Widen from 2 to 4 lanes	Modeling	2030	Partial	TMP, Build Out, TIP
4	Red-Wood Road and 164th Avenue NE	South of NE 90th Street	Decrease from 4 to 2 lanes	Modeling	2010	Yes	TMP, TFP
5	Redmond Way	159th Place to 170th Avenue NE	Decrease from 3 to 2 lanes	Modeling, Synchro	2030	No	TMP, TFP
6	Novelty Hill Road	Avondale Road to 243rd Avenue NE	Widen from 2 to 4 lanes	Modeling	2030	Yes	TMP, TIP
7	NE 85th Street	158th Avenue NE to 164th Avenue NE	Decrease from 4 to 2 lanes	Modeling	2010	Yes	TMP, TFP
8	Cleveland Street	160th Avenue NE to Avondale Way	Decrease from 3 to 2 lanes	Modeling, Synchro	2030	No	TMP, TFP
9	161st Avenue NE	Bear Creek Parkway Extension to Redmond Way	Construct new Roadway	Modeling, Synchro	2030	Partial	TMP, TFP
10	Union Hill Road	From Avondale Road to 178th Place NE	Increase number of lanes	Synchro	2010	Yes	TFP, TIP
11	Union Hill Road	From 178th Place NE to 188th Avenue NE	Increase number of lanes	Modeling, Synchro	2010	Yes	TFP, TIP
12	Redmond Way	SR-520 to 187th Ave NE	Increase number of lanes	Modeling, Synchro	2010	Yes	TFP, TIP
13	NE 116th Street	Red-Wood Road to Avondale Road	Add two-way left-turn lane	Modeling	2030	Partial	TFP, TIP
14	Redmond Way and East Lake Sammamish Parkway at 180th Avenue NE		Improve intersection	Synchro	2010	Yes	TFP

TABLE 16
City Of Redmond's Planned Project Improvements

Project Number	Street	Limits	Description	Comments	Year of Opening (in-place)	Funded	Programs
15	Union Hill Road at Avondale Road		Improve intersection	Synchro	2010	Yes	TFP
16	Old Redmond Road	132nd Avenue to 140th Avenue	Add two-way left-turn lane	Modeling	2010	Yes	TFP
17	Redmond Way at 76th Street		Improve intersection	Synchro	2010	Yes	TFP, TIP
18	Union Hill Road at 178th Place NE		Improve intersection	Synchro	2010	Yes	Build Out
19	West Lake Sammamish Parkway at Leary Way		Improve intersection	Synchro	2030	No	Build Out

Analysis Results

Overall Volumes and Travel Patterns

The total volume of east-west trips was similar for the No-Action and Build Alternatives. Much of the growth planned for the City of Redmond before 2030 is expected to occur by the year 2010; therefore, substantial changes between 2010 and 2030 volumes were not observed. However, more trips used SR 520 in the Build Alternative than in the No-Action due to the additional freeway capacity. Modeling indicated that vehicles would divert off the mainline and use the local arterials in the No-Action Alternative because of the congestion experienced along SR 520. With the additional capacity in the Build Alternative, trips that previously diverted off the SR 520 mainline now would remain on the facility and therefore more throughput was observed along SR 520 in the Build than in the No-Action Alternative. The Build Alternative would result in heavier volumes exiting the freeway at NE Union Hill Road and heading north toward Avondale Road NE because more vehicles remain would remain on the SR 520 facility in the Build Alternative. The summary conclusions from the future year No-Action and Build Alternatives include:

- Congestion relief along SR 520 and SR 202 would be observed under the Build Alternative (when compared to the No-Action). Up to 6 minutes of travel time savings was estimated along SR 520 (westbound direction, year 2010).
- Added capacity along SR 520 in the Build Alternative would allow more vehicles throughput. For several areas along the SR 520 corridor, more than twice as many vehicles used SR 520 in the Build Alternative (compared to the No-Action Alternative) in both future years.
- The proposed SR 202 flyover improved travel times along SR 202 by over 10 minutes in the westbound direction.
- The proposed project would address the high accident rate at the eastbound SR 520 off-ramp to SR 202 by adding capacity in the area and realigning the ramp diverge, which would improve sight distance. Most accidents in this area are rear-end collisions related to congestion.
- No local arterial mitigation would be warranted as a result of the Build Alternative because operations on local arterials are not negatively affected. In fact, the proposed project would improve operations along the SR 202 corridor in the future.

Travel Patterns and Traffic Volumes

AM Peak Hour

Westbound SR 520 does not experience heavy congestion under existing conditions, although there is heavy demand at the east-end entry point to the facility. Westbound SR 520 would operate in the same fashion under the No-Action Alternative. At the intersection of SR 520 with Avondale Road Extension and NE Union Hill Road, two movements onto the highway serve particularly high volumes of traffic: southbound on Avondale Road Extension, and westbound on NE Union Hill Road. This congested intersection acts as a meter to traffic entering

westbound SR 520. Additionally, to bypass this congestion vehicles use alternate arterial routes (such as West Lake Sammamish Parkway) and access SR 520 at points farther west such as the West Lake Sammamish interchange or the 51st Street interchange. With a capacity addition to SR 520 in the Build Alternative, travel patterns would to shift. More vehicles would use the SR 520 corridor as well as the intersection of NE Union Hill Road and Avondale Road Extension.

Traffic traveling between westbound SR 202 and westbound SR 520 would experience time savings and improved access to the highway with the addition of the proposed SR 202 flyover. The new flyover ramp would provide faster and more direct access to westbound SR 520 without requiring drivers to stop at a traffic signal. The added capacity on the SR 520 mainline, in combination with the new SR 202 flyover ramp, would relieve congestion and reduce commuter travel times. Additionally, the added HOV lanes in the Build alternative would provide a continuous trip from Redmond to the SR 520 Bridge deck, allowing carpools and transit seamless access, increased travel speeds, and time savings during peak periods.

PM Peak Hour

In the PM peak hour, under both existing conditions and the No-Action Alternative, traffic on eastbound SR 520 would experience extensive queuing approaching the east end terminus. In the PM peak hour, some vehicles currently exit before the terminus and divert to the arterial network, particularly at West Lake Sammamish Parkway and SR 202. They would continue to do this in the No-Action Alternative. With the added capacity at the eastern end of SR 520 in the Build Alternative, the travel model projected that vehicles stay on the mainline longer, with less diversion to the arterial network.

Comparing the forecasted volumes between the future No-Action and Build alternative (2010 and 2030), it becomes evident that the total number of east-west trips through Redmond would stay relatively the same; however, trip patterns east of West Lake Sammamish Parkway would differ between the No-Action and Build Alternatives. With additional capacity included in the Build Alternative along SR 520, vehicles would remain on SR 520 longer.

SR 520 Mainline, Ramp, and Weave Operations

This section provides information on AM and PM peak hour traffic operations for the No-Action Alternative and the Build Alternative (2010 and 2030 volume alternatives). Comparisons of mainline operations were made using LOS, travel time, and throughput MOEs. Tables 17 and 18 show the estimated operations for each future condition for eastbound and westbound SR 520, respectively. In the eastbound direction, improvements to the No-Action Alternative between 2010 and 2030 would be caused by geometric changes at the intersection of West Lake Sammamish Parkway and Leary Way as well as at the intersection of Avondale Road Extension and Union Hill Road. In particular, the City of Redmond has planned improvements on each leg of the Avondale Road Extension and Union Hill Road intersection (these improvements have been assumed in the No Action and Build alternatives for years 2010 and 2030).

The Build Alternative would result in an overall operational improvement in 2010 and 2030 when compared to the No-Action Alternative, particularly in 2030. Failing operational conditions were reported in the No-Action Alternative analysis at several locations. In the Build Alternative, LOS B or better in all eastbound segments of SR 520 would be estimated under the 2010 Build Alternative. Under the 2030 Build Alternative, the overall the study corridor would

likely experience an improvement in operations over the No-Action Alternative; however, failing conditions were observed west of the West Lake Sammamish Parkway off-ramp.

TABLE 17
Eastbound SR 520 Level of Service[1]

Freeway Segment, Ramp, or Weave	AM Peak Hour				PM Peak Hour			
	2010 No-Action	2010 Build	2030 No-Action	2030 Build	2010 No-Action	2010 Build	2030 No-Action	2030 Build
Before West Lake Sammamish Parkway	B	B	F	B	F	B	F	F
West Lake Sammamish Parkway off-ramp diverge	B	B	B	D	C	B	D	F
West Lake Sammamish Parkway interchange area mainline	C	B	B	B	B	B	F	D
West Lake Sammamish Parkway on-ramp merge	D	A	C	B	B	B	F	C
West Lake Sammamish Parkway on-ramp to SR 202 off-ramp[2]	D	A	D	B	C	B	F	C
SR 202 off-ramp diverge	E	A	E	B	B	B	C	C
SR 202 off-ramp to NE Union Hill Road	F	A	F	B	C	A	C	B

[1]Year 2010 and 2030
[2]Because of lane configuration changes under the Build Alternative, this area operates as a weave.

TABLE 18
Westbound Level of Service[1]

Freeway Segment, Ramp, or Weave	AM Peak Hour				PM Peak Hour			
	2010 No-Action	2010 Build	2030 No-Action	2030 Build	2010 No-Action	2010 Build	2030 No-Action	2030 Build
Before West Lake Sammamish Parkway	D	B	D	B	C	A	B	A
West Lake Sammamish Parkway off-ramp diverge	C	F	C	B	C	A	B	B
West Lake Sammamish Parkway interchange area mainline	C	F	C	B	C	B	B	B
West Lake Sammamish Parkway on-ramp merge	C	F	C	B	B	B	B	B
West Lake Sammamish Parkway on-ramp to SR 202 off-ramp[2]	B	C	B	B	B	B	B	B
SR 202 off-ramp diverge	B	B	B	A	B	B	A	B
SR 202 off-ramp to NE Union Hill Road	B	C	B	B	B	B	B	B

[1]Year 2010 and 2030
[2]Because of the lane configuration under the Build Alternative, this area operates as a weave

In the AM peak hour, failing conditions were observed in the 2010 No-Action Alternative analysis at the east end of the SR 520 corridor (SR 202 off-ramp to NE Union Hill Road). In the Build Alternative, this segment would improve to LOS A. In the 2030 No Action Alternative, failing operations would be observed at the area west of the West Lake Sammamish Parkway interchange area and at the east end of the corridor; in the Year 2030 Build Alternative, this study corridor would improve to LOS D or better.

In the PM peak hour, failing conditions were noted west of the West Lake Sammamish Parkway interchange in the 2010 and 2030 No-Action Alternative. Operations would improve to LOS B in the Year 2010 Build Alternative and would remain failing in the 2030 Build Alternative. Failing conditions were also noted in the 2030 No-Action Alternative at the West Lake Sammamish Parkway on-ramp through the SR 202 off-ramp. In the Year 2030 Build Alternative this area would improve to LOS D or better.

In the westbound direction, most of the corridor would experience operational improvements between the No-Action and Build alternatives. There were several locations, however, that would experience an LOS rating degradation between the No-Action and Build alternatives.

In the AM peak hour, failing operations would be experienced under the 2010 Build condition in the vicinity of the SR 202 on-ramp to the west Lake Sammamish Parkway interchange area along westbound SR 520. Degradation in LOS between the No-Action and Build alternatives would occur in the vicinity of the West Lake Sammamish Parkway interchange area. By implementing the SR 202 flyover, additional traffic volume would access the SR 520 corridor rather than using the local arterial network. Due to increased capacity, increased traffic volumes would continue just downstream from the SR 202 flyover on-ramp into the weaving area, degrading the LOS along the mainline. By the year 2030, however, when the HOV lane would be placed on the inside of the SR 520 corridor, LOS in this vicinity would likely improve over the 2010 Build (in 2010, an HOV lane would not assumed to be in this vicinity).

In the PM peak hour, traffic operations would remain relatively similar between the No-Action and Build alternatives in the westbound direction. The SR 202 diverge would change from an LOS A to an LOS B in the Build Alternative (in both 2010 and 2030).

Travel Times

AM and PM peak hour travel times for routes in the study area are presented as a measure of the alternative's ability to efficiently provide mobility during periods of high use. The travel routes were selected to represent the primary travel patterns in the study area. Tables 19 and 20 present travel times for particular routes for 2010 and 2030 peak hours.

Travel times would improve or stay the same for most routes in both peak hours under the Build Alternative. In general, improvements in travel time can be attributed to three improvements: an auxiliary lane constructed between the West Lake Sammamish Parkway and SR 202 interchanges along eastbound and westbound SR 520; additional HOV lanes in both directions of SR 520; and a flyover ramp from northbound SR 202 to westbound SR 520.

The SR 520 auxiliary lanes would reduce merging delays experienced on eastbound SR 520 today. Without the increased capacity, the No-Action Alternative would experience heavy congestion at the east end of SR 520, resulting in substantially higher travel times. The flyover ramp would significantly reduce travel times along SR 202, particularly in the southbound

direction. This is because the southbound to westbound phase will be removed from the signal at SR 202 and NE 76th Street as part of the Build Alternative, reducing signal delays and queuing.

Travel time was shown to increase on one route, through the Avondale/NE Union Hill Road intersections to SR 520 westbound in the 2030 AM peak hour. This is because more traffic would travel through this intersection under the Build alternative due to improved capacity along SR 520.

TABLE 19
2010 Corridor Travel Times[1]

Travel Route Description	AM Peak Hour		PM Peak Hour	
	No-Action	Build	No-Action	Build
SR 520 eastbound: general purpose lanes from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	3	2	3	2
SR 520 eastbound: HOV lane from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	3	2	4	2
SR 520 westbound: general purpose lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	11	5	3	3
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	11	5	3	3
NE Union Hill Road (east of Avondale Road Extension) to SR 520 westbound west of West Lake Sammamish Parkway (general purpose)	6	10	3	3
NE Union Hill Road (east of Avondale Road Extension) to SR 520 westbound west of West Lake Sammamish Parkway (HOV)	5	10	3	3
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 westbound west of West Lake Sammamish Parkway (general purpose)	12	5	18	4
SR 202 westbound (east of West Lake Sammamish Parkway) through past NE 170th Avenue NE (general purpose)	7	3	13	3
SR 202 eastbound (west of NE 170th Avenue NE) through past East Lake Sammamish Parkway (general purpose)	4	3	4	4

[1]Travel times are expressed in minutes

TABLE 20
2030 Corridor Travel Times[1]

Travel Route Description	AM Peak Hour		PM Peak Hour	
	No-Action	Build	No-Action	Build
SR 520 eastbound: general purpose lanes from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	3	2	3	3
SR 520 eastbound: HOV lane from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	3	2	3	2
SR 520 westbound: general purpose lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	9	4	5	4
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	9	3	5	4
NE Union Hill Road (east of Avondale Road Extension) to SR 520 general purpose lanes westbound west of West Lake Sammamish Parkway	7	10	5	4
NE Union Hill Road (east of Avondale Road Extension) to SR 520 HOV Lanes westbound west of West Lake Sammamish Parkway	7	12	5	4
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 general purpose lanes westbound west of West Lake Sammamish Parkway	12	5	14	4
SR 202 westbound (east of East Lake Sammamish Parkway) through past NE 170th Avenue NE (general purpose)	9	5	11	3
SR 202 eastbound (west of NE 170th Avenue NE) through past east Lake Sammamish Parkway (general purpose)	7	5	6	5

[1]Travel times are expressed in minutes

For 2010, substantial improvements would be observed along SR 520, due to the increase in capacity and the extension of the HOV lane. Additionally, travel time improvements would also be observed along SR 202 due to the inclusion of the flyover. For vehicles traveling westbound on SR 202 headed for westbound SR 520, the flyover would eliminate the need to travel through one intersection. In addition, because the heavy flyover volume would be eliminated from the SR 202/NE 76th Street intersection, the signal phasing would be optimized, which would provide operational improvements along the SR 202 corridor.

Similar to Year 2010 results, travel times in the Year 2030 analysis improved throughout most of the corridor. These improvements were primarily the result of inclusion of the SR 520 HOV lanes as well as the implementation of the SR 202 flyover. The most substantial difference was due to the implementation of the of the SR 202 flyover. In the No-Action Alternative, travel times between SR 202 east of East Lake Sammamish Parkway to westbound SR 520 west of West Lake Sammamish Parkway was 12 minutes in the AM peak hour and 18 minutes in the PM peak hour. In the Build Alternative, the travel times were projected to be 5 minutes and 4 minutes, respectively.

Travel times on one route degraded between the No-Action and Build Alternatives for both GP and HOV vehicles. The route begins at NE Union Hill Road (east of Avondale Road Extension), goes through the NE Union Hill Road/Avondale Road Extension intersection, and continues on to westbound SR 520 west of West Lake Sammamish Parkway. Given the added capacity along SR 520, the corridor would become more attractive and vehicles would use the facility rather than using the local arterial system as would occur in the No-Action Alternative). Given the higher volume in the Build Alternative, drivers would spend more time at the NE Union Hill Road/Avondale Road Extension intersection, increasing the overall travel time. In the traffic model HOV bypass was not assumed at the NE Union Hill Road/Avondale Road Extension intersection; therefore, both HOV and GP users experienced a delay.

Vehicle Throughput

Increases in throughput between the No-Action and Build Alternatives along SR 520 were attributed to demand increases along the route due to capacity improvements, making the travel route more attractive. These two factors would work in combination to increase throughput along most routes during both the AM and PM peak hours. Vehicle throughput increased by two times or more in multiple sections, as indicated in Tables 21 and 22 below.

TABLE 21
2010 Corridor Throughput[1]

Travel Route Description	AM Peak Hour		PM Peak Hour	
	No-Action	Build	No-Action	Build
SR 520 eastbound: general purpose lanes from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	950	1050	905	1190
SR 520 eastbound: HOV lane from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	105	110	120	170
SR 520 westbound: general purpose lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	630	1530	480	510
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	85	80	40	45
NE Union Hill Road (east of Avondale Road Extension) to SR 520 westbound west of West Lake Sammamish Parkway	610	525	240	260
NE Union Hill Road (east of Avondale Road Extension) to SR 520 westbound west of West Lake Sammamish Parkway	40	30	20	20
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 westbound west of West Lake Sammamish Parkway	385	560	110	400
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 westbound west of West Lake Sammamish Parkway	25	55	10	40
SR 202 westbound (east of ELSP) through past NE 170th Avenue NE	195	220	90	315
SR 202 eastbound (west of NE 170th Avenue NE) through past East Lake Sammamish Parkway	180	190	415	445

[1]Expressed in number of vehicles

TABLE 22
2030 Corridor Throughput[1]

Travel Route Description	AM Peak Hour		PM Peak Hour	
	No-Action	Build	No-Action	Build
SR 520 eastbound: general purpose lanes from before West Lake Sammamish Parkway to the Avondale Road Extension and NE Union Hill Road intersection	1,065	1,120	1,055	1,935
SR 520 eastbound: HOV lane from before West Lake Sammamish Parkway to the Avondale Road and NE Union Hill Road intersection	65	75	90	225
SR 520 westbound: general purpose lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	740	1,580	615	635
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	15	195	45	40
NE Union Hill Road (east of Avondale Road) to SR 520 general purpose lanes westbound west of West Lake Sammamish Parkway	605	385	390	310
NE Union Hill Road (east of Avondale Road) to SR 520 HOV Lanes westbound west of West Lake Sammamish Parkway	90	35	20	20
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 general purpose lanes westbound west of West Lake Sammamish Parkway	170	420	130	440
SR 202 westbound (east of East Lake Sammamish Parkway) to SR 520 HOV lanes westbound west of West Lake Sammamish Parkway	30	70	15	25
SR 202 westbound (east of East Lake Sammamish Parkway) through past NE 170th Avenue NE	80	240	100	365
SR 202 eastbound (west of NE 170th Avenue NE) through past East Lake Sammamish Parkway	165	230	290	490

[1]Expressed in number of vehicles

The 2010 corridor throughput presented in Table 21 shows that corridor throughput would either remain the same or improve in the Build Alternative compared to the No-Action Alternative for most routes. The most substantial throughput differences were due to capacity improvements along SR 520 as well as the implementation of the SR 202 flyover.

Similarly to the 2010 corridor throughput, increases in corridor throughput in the 2030 Build Alternative were due primarily to the added capacity along SR 520 as well as the inclusion of the SR 202 flyover.

Similar to the travel time results, the only decreases between No-Action and Build alternatives would occur on the route from Union Hill Road to westbound SR 520. Although there would be a decrease in throughput along this route, a substantial increase in throughput would be noted from Avondale Road to westbound SR 520, indicating that an overall increase in throughput at the Avondale Road and Union Hill Road intersection would be observed.

Intersection Operations

This section describes how the project alternatives would affect traffic operations at project area intersections for years 2010 and 2030. LOS is the MOE used to compare the Build Alternative to the No-Action Alternative at local intersections. LOS, vehicle volumes, and lane configurations at study area intersections are shown in Appendix B, while LOS and average delay are shown in Table 23. The section below reviews intersections of particular interest; results at all project-area intersections can be found in Table 23.

TABLE 23

SR520/SR 202 Peak Hour Intersections for Year 2010 and Year 2030 (No-Action and Build): Optimized Cycle Lengths

	AM Peak Hour				PM Peak Hour			
Peak Hour	**2010 No Action**	**2010 Build**	**2030 No Action**	**2030 Build**	**2010 No Action**	**2010 Build**	**2030 No Action**	**2030 Build**
SR 202 and Bear Creek Crossing	LOS D 35 s/veh	LOS D 36 s/veh	LOS F 101 s/veh	LOS B 11 s/veh	LOS A 9 s/veh	LOS A 7 s/veh	LOS E 60 s/veh	LOS A 9 s/veh
SR 202 and 170th Avenue North	LOS C 22 s/veh	LOS C 22 s/veh	LOS E 72 s/veh	LOS D 41 s/veh	LOS F 93 s/veh	LOS D 54 s/veh	LOS E 64 s/veh	LOS E 60 s/veh
SR 202 and NE 76th Street	LOS D 44 s/veh	LOS D 38 s/veh	LOS F 90 s/veh	LOS D 42 s/veh	LOS D 44 s/veh	LOS E 75 s/veh	LOS E 75 s/veh	LOS D 49 s/veh
SR 202 and SR 520 off-ramp	LOS F 107 s/veh	LOS B 14 s/veh	LOS F 93 s/veh	LOS D 51 s/veh	LOS F 92 s/veh	LOS E 77 s/veh	LOS E 77 s/veh	LOS D 36 s/veh
SR 202 and NE 70th Street	LOS E 69 s/veh	LOS B 10 s/veh	LOS E 75 s/veh	LOS D 41 s/veh	LOS E 64 s/veh	LOS C 29 s/veh	LOS E 78 s/veh	LOS D 39 s/veh
SR 202 and 180th Avenue NE	LOS F 130 s/veh	LOS D 39 s/veh	LOS F 126 s/veh	LOS F 99 s/veh	LOS F 128 s/veh	LOS E 56 s/veh	LOS F 113 s/veh	LOS F 83 s/veh
West Lake Sammamish Parkway and eastbound SR 520 on- and off-ramp	LOS C 23 s/veh	LOS C 30 s/veh	LOS F 86 s/veh	LOS F 97 s/veh	LOS F 131 s/veh	LOS D 49 s/veh	LOS D 45 s/veh	LOS E 68 s/veh
West Lake Sammamish Parkway and westbound SR 520 on- and off-ramp	LOS F 90 s/veh	LOS E 79 s/veh	LOS F 109 s/veh	LOS F 150 s/veh	LOS E 67 s/veh	LOS D 45 s/veh	LOS D 44 s/veh	LOS E 68 s/veh
Avondale Road NE and Avondale Road Extension	LOS F 100 s/veh	LOS A 6 s/veh	LOS E 79 s/veh	LOS B 13 s/veh	LOS B 11 s/veh	LOS B 11 s/veh	LOS B 12 s/veh	LOS B 17 s/veh
Avondale Road Extension and NE Union Hill Road	LOS F 117 s/veh	LOS F 87 s/veh	LOS F 117 s/veh	LOS F 117 s/veh	LOS C 31 s/veh	LOS D 36 s/veh	LOS E 60 s/veh	LOS E 60 s/veh
Avondale Way NE and NE Union Hill Road	LOS A 7 s/veh	LOS A 7 s/veh	LOS B 10 s/veh	LOS B 18 s/veh	LOS B 11 s/veh	LOS A 8 s/veh	LOS A 8 s/veh	LOS B 11 s/veh

s/veh seconds per vehicle

SR 202 and NE 76th Street

In the Build Alternative, the SR 202 flyover would negate the need for westbound SR 202 traffic to use this intersection to access westbound SR 520. Therefore, in the Build Alternative model the dual left-turn lanes were removed. The removal of the dual left-turn lanes improved operations at the intersection because fewer vehicles traversed the intersection and signal phasing was optimized for the other directional volumes. See Appendix B for an illustration of the proposed Build Alternative channelization. The greatest improvement at this intersection was in the 2030 model, when LOS improved from LOS F to LOS D in the AM peak hour.

SR 202 and Eastbound SR 520 Off-Ramp

In 2010 under the No-Action Alternative, this intersection had failing operations in both peak hours. In the Build Alternative model, operations improved to LOS B and LOS E in the AM and PM peak hours, respectively. In 2030 under the No-Action Alternative, the intersection operated at LOS F in the AM peak hour and LOS E in the PM peak hour, but improved to LOS D in both the AM and PM peak hours under the Build Alternative. Improved operations would be primarily due to the SR 202 flyover and the corridor improvement that the flyover provides along SR 202.

SR 202 and NE 70th Street

In 2030 in the PM peak hour, this intersection improved from LOS E to LOS D in the Build Alternative.

SR 202 and 180th Avenue NE

This intersection failed in the AM and PM peak hour models under the No-Action Alternative in 2010 and 2030. The Build Alternative would improve operations to LOS E or better.

West Lake Sammamish Parkway and SR 520 Eastbound Ramps

Under existing and 2010 baseline conditions, the northbound right-turn delay caused the signal to fail in the PM peak hour, and traffic backs all the way to the SR 520 eastbound off-ramp and onto eastbound SR 520. Sometime before 2030, an additional southbound left-turn lane is programmed for installation, as well as a second receiving lane in the east approach (over the Sammamish River). These geometric changes will improve intersection operations as a whole, and the northbound right-turn movement in particular. Failing operations would be observed, however, in the AM peak hour for both the No-Action and Build alternatives in the Year 2030. The addition of a double southbound left and eastbound capacity addition improved LOS under the 2010 No-Action Alternative in the PM peak hour from LOS F to LOS D. The Build Alternative did not improve upon the No-Build Alternative LOS in the PM peak hour.

West Lake Sammamish Parkway, NE Leary Way, and SR 520 Westbound On- and Off-Ramps

In 2010, this intersection failed during the PM peak hour. The Build Alternative improved LOS in 2010 to LOS D in both the AM and PM peak hour. The City of Redmond CIP project scheduled for the intersection of West Lake Sammamish Parkway and NE Leary Way (described above) will improve operations at this intersection as well, so that by 2030 modeling of the No-Build Alternative resulted in LOS D during the PM peak hour. The Build Alternative did not improve LOS in the PM peak hour, but improved AM peak hour delay slightly.

Avondale Road Extension and NE Union Hill Road

Under the NE Union Hill Road Phase Two project (City of Redmond), the configuration of future channelization at this intersection is currently being considered. As part of this study, the project team incorporated the City of Redmond's channelization recommendations for this intersection into all scenarios. See Appendix B for an illustration of the proposed channelization.

In 2010 and 2030, AM peak hour operation would remain at failing conditions between the No-Action and Build alternatives. While the intersection would remain at LOS F under the Build Alternative, it accommodated more traffic. In the PM peak hour, Year 2010 operations would degrade from LOS C to LOS D in the Build Alternative. By the Year 2030, the LOS would remain at LOS E for both alternatives. The slight increases in delay in 2010 and 2030 under the Build Alternative occurred because more traffic moves through the intersection when the project is built.

Avondale Way NE and NE Union Hill Road

Although this intersection operates very well under both the No-Action and Build Alternatives, the Build Alternative caused average delay to increase slightly in some scenarios. This is because more traffic would move through the intersection when the project is built.

Transit and HOVs

The Build Alternative proposes several capacity improvements that benefit HOVs and transit. First, the HOV lanes along SR 520 would extend to the eastern terminus of the corridor. Second, the SR 202 flyover would have one lane designated to HOVs (the other lane, GP, would be metered). These proposed improvements would benefit HOV and transit traffic. The added HOV lanes in the Build Alternative would provide a continuous trip from the SR 520 Bridge deck to Redmond, allowing carpools and transit seamless access, increased travel speeds, and time savings during peak hours. Additionally, it can be shown that HOVs and transit would experience travel time savings over GP traffic in the Build Alternative. The following illustrates the benefits as well as potential opportunities in the future.

Year 2010 and 2030 Travel Times for HOV and Transit

On SR 520, the benefits of the project to transit would be the same as those for HOVs. As shown in Table 24, by 2010 travel time would be reduced in both directions and in both peak periods (or remain the same) compared with the No-Action Alternative. Vehicles traveling westbound during the AM peak hour would experience the greatest travel-time savings. During this period, the model showed that transit vehicles using the HOV saved 6 minutes per trip compared to the No-Action alternative.

As shown in Table 25, 2030 travel times were reduced in both directions and in both peak periods (except for the SR 520 westbound route in the PM peak hour) compared with the No-Action Alternative. The greatest travel-time savings occurred in the westbound direction during the AM peak hour, when transit vehicles using the HOV lanes saved 6 minutes per trip compared to the No-Action Alternative.

TABLE 24
2010 HOV Lane Travel Times[1]

Travel Route Description	AM Peak Hour		PM Peak Hour	
	No-Action	Build	No-Action	Build
SR 520 eastbound: HOV lane from before West Lake Sammamish Parkway to the Avondale Road and NE Union Hill Road intersection	3	2	4	2
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	11	5	3	3

[1]Travel times are expressed in minutes

TABLE 25
2030 HOV Lane Travel Times[1]

Travel Route Description	AM Peak Period		PM Peak Period	
	No-Action	Build	No-Action	Build
SR 520 eastbound : HOV lane from before West Lake Sammamish Parkway to the Avondale Road NE and NE Union Hill Road intersection	3	2	4	2
SR 520 westbound: HOV lanes from east of Avondale Road Extension (on Avondale Road NE) to SR 520 westbound west of West Lake Sammamish Parkway	11	5	3	3

[1]Travel times are expressed in minutes

Transit vehicles using SR 202 and other local arterials would also benefit from the Build Alternative compared to the No-Action Alternative. For example, King County Metro route 233 travels from Redmond to Seattle through three study area intersections: Avondale Road NE/Avondale Road Extension; Avondale Road Extension/NE Union Hill Road; and NE 76th Street/SR 202. Modeling showed that the route would save 24.5 seconds of control delay (waiting at signals) per trip compared with the No-Action Alternative in the AM peak hour, and 8.7 seconds per trip in the PM peak hour. By 2010, the savings would increase to 48.4 seconds savings per trip in the AM peak hour and 21.7 seconds per trip in the PM peak hour. There is somewhat limited transit service traversing the entire study corridor (utilizing the Bear Creek Park-and-Ride). Given the proposed HOV improvements along SR 520, additional transit service could be considered.

Nonmotorized

The project would improve pedestrian and bicycle access and safety at the SR 520 and SR 202 interchange by providing a marked route for nonmotorized travelers to bypass the interchange area. Bicycles and pedestrians would be prohibited along the north side of SR 202 between the new mixed-use path and NE 76th Street in order to avoid conflicts with the flyover ramp. They would also be prohibited from crossing the SR 520 eastbound off-ramp near the East Lake Sammamish Trail by an existing right-of-way fence.

The new pedestrian and bicycle route, illustrated in Figure 5, would link the East Lake Sammamish Trail with downtown Redmond and the Bear Creek Trail, diverting travelers to the east side of SR 202 via a signalized crossing at the intersection of SR 202 and NE 70th Street. The path would then travel north along SR 202 to a separate mixed-use path leading to NE 76th Street, where travelers could continue west back to SR 202. Alternatively, pedestrians could continue to use the sidewalk on the south side of SR 202 between the signals at NE 70th Street and NE 76th Street by using a signalized crosswalk at the intersection of the SR 520 eastbound off-ramp with SR 202.

Because this marked path would provide a way to cross the SR 520 eastbound off-ramp at SR 202 and would augment signing of this route, pedestrians and bicyclists would be less likely to attempt to cross the off-ramp at the railroad right-of-way crossing, which has caused accidents in the past.

Truck and Rail Freight

Trucks would experience benefits comparable to GP vehicles on both SR 520 and SR 202. Additionally, no freight railroads are expected to be operational in the project area by 2010.

Mitigation Measures

The Build Alternative assumes the following improvements in the study area:

- Add an HOV lane and an auxiliary lane in each direction of SR 520 at the West Lake Sammamish Parkway and SR 202 interchange areas. Additional bridges would allow three lanes of traffic (two GP and one HOV) in each direction on SR 520 to access NE Union Hill Road, eliminating the current single lane bottlenecks in each direction at SR 202.
- Construct a new flyover ramp connection westbound SR 202 to westbound SR 520. The flyover would replace the westbound left-turn lanes on SR 202 at NE 76th Street, removing westbound left turns to SR 520 from the intersection and reconfiguring the intersection to accommodate the new layout. The two-lane flyover would have one lane designated for HOVs and the GP lane would be metered. In addition, during peak hours, a storage lane (12-foot storage plus a 2-foot shoulder) on the flyover would be used to serve as an additional GP lane to accommodate the projected demand in the future (this storage lane would be metered and used only during the peak hours).
- Complete improvements to the West Lake Sammamish interchange. The West Lake Sammamish interchange would be upgraded, with new ramp bridges over the Sammamish River and West Lake Sammamish Parkway

Regional and local planned/programmed projects have been accounted for in the future models (2010 and 2030). The Build Alternative improvements would relieve SR 520 congestion, improve travel times on both the SR 520 and SR 202 corridors, address the high accident rate at the eastbound SR 202 off-ramp (on SR 520) and show travel time savings for transit/HOV users. Given the traffic analysis results, the proposed project would not create negative impacts that would warrant traffic mitigation measures, and consequently none are proposed.

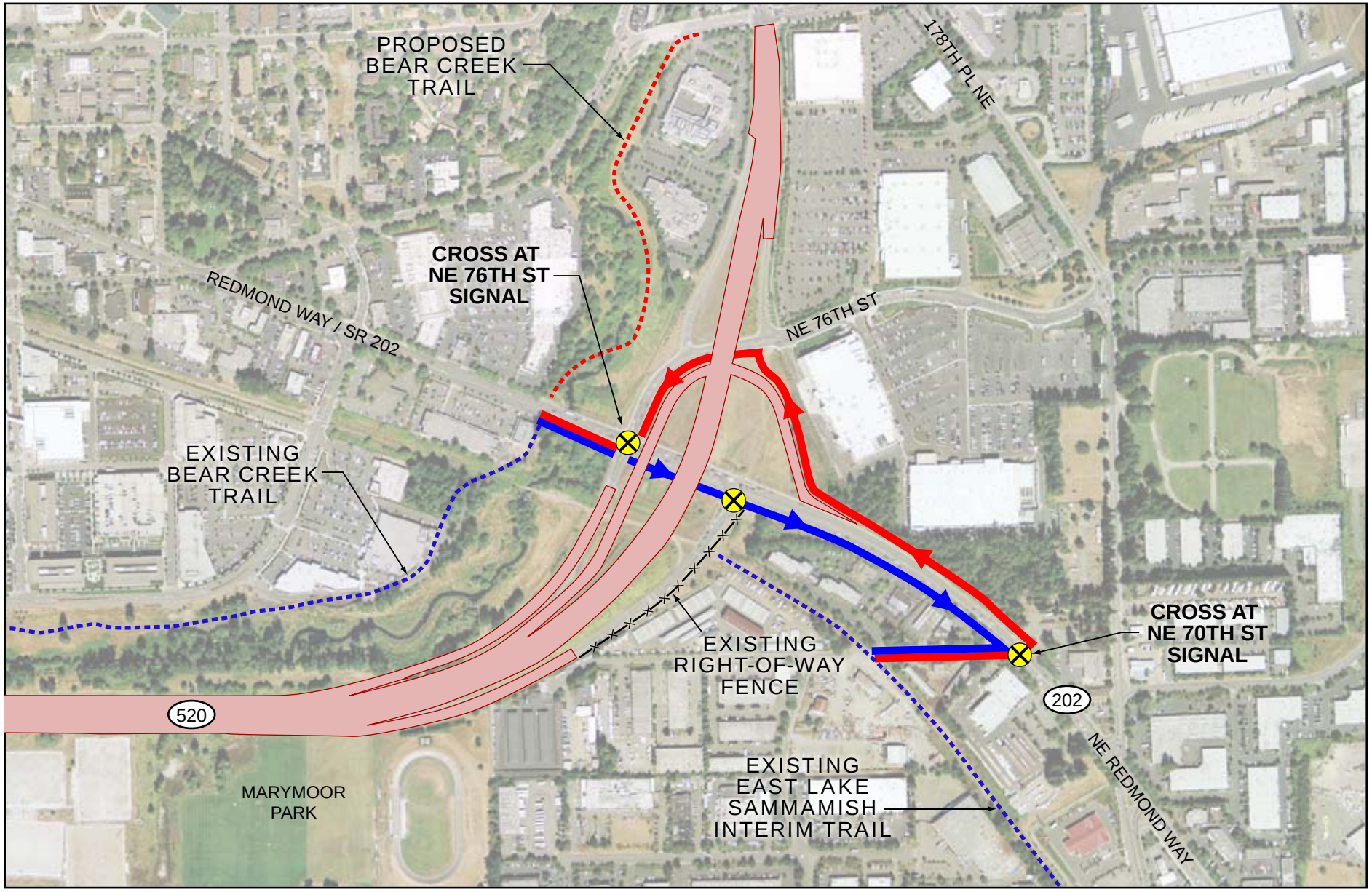

FIGURE 5

Proposed Pedestrian and Bicycle Routing at SR 520/SR 202 Interchange

SR 520/West Lake Sammamish Parkway to SR 202

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APPENDIX A

Mainline SOV and HOV Volumes

APPENDIX A

Mainline SOV and HOV Volumes

Existing Conditions

EB SR 520 - AM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	2,465	630	1,835	260	2,090	935	1,155	45	1,200
HOV (2+)	225	65	160	15	180	65	115	5	120
Total	**2,690**	**695**	**1,995**	**275**	**2,270**	**1,000**	**1,270**	**50**	**1,320**

EB SR 520 - PM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	3,680	1,200	2,485	280	2,770	1,510	1,260	35	1,300
HOV (2+)	350	100	245	20	260	100	160	5	160
Total	**4,030**	**1,300**	**2,730**	**300**	**3,030**	**1,610**	**1,420**	**40**	**1,460**

WB SR 520 - AM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	2,300	100	2,195	1,765	3,955	240	3,715	1,080	4,790
HOV (2+)	155	10	150	145	300	20	280	75	360
Total	**2,455**	**110**	**2,345**	**1,910**	**4,255**	**260**	**3,995**	**1,155**	**5,150**

WB SR 520 - PM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	950	95	855	1,210	2,065	235	1,830	1,070	2,900
HOV (2+)	80	5	75	100	175	15	160	70	230
Total	**1,030**	**100**	**930**	**1,310**	**2,240**	**250**	**1,990**	**1,140**	**3,130**

2010 No-Action Volumes

EB SR 520 - AM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
Non-HOV	2,550	650	1,895	285	2,180	965	1,210	45	1,260
HOV (2+)	230	65	170	15	185	70	120	10	125
Total	**2,780**	**715**	**2,065**	**300**	**2,365**	**1,035**	**1,330**	**55**	**1,385**

EB SR 520 - PM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
Non-HOV	3,765	1,245	2,525	290	2,820	1,570	1,250	45	1,300
HOV (2+)	355	105	245	20	260	105	155	10	160
Total	**4,120**	**1,350**	**2,770**	**310**	**3,080**	**1,675**	**1,405**	**55**	**1,460**

WB SR 520 - AM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
Non-HOV	2,330	100	2,225	1,835	4,055	245	3,805	1,150	4,955
HOV (2+)	155	10	150	150	305	20	290	80	370
Total	**2,485**	**110**	**2,375**	**1,985**	**4,360**	**265**	**4,095**	**1,230**	**5,325**

WB SR 520 - PM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
Non-HOV	980	95	880	1,245	2,120	235	1,880	1,100	2,980
HOV (2+)	80	10	75	100	180	20	165	75	240
Total	**1,060**	**105**	**955**	**1,345**	**2,300**	**255**	**2,045**	**1,175**	**3,220**

2010 Build

EB SR 520 - AM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	2,565	655	1,905	285	2,185	970	1,210	45	1,260
HOV (2+)	230	65	170	15	190	70	125	10	130
Total	**2,795**	**720**	**2,075**	**300**	**2,375**	**1,040**	**1,335**	**55**	**1,390**

EB SR 520 - PM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	3,855	1,235	2,625	290	2,920	1,555	1,360	40	1,405
HOV (2+)	365	105	255	20	270	105	170	10	175
Total	**4,220**	**1,340**	**2,880**	**310**	**3,190**	**1,660**	**1,530**	**50**	**1,580**

WB SR 520 - AM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	2,490	100	2,380	1,805	4,175	245	3,925	1,085	5,010
HOV (2+)	165	15	160	145	315	20	300	75	375
Total	**2,655**	**115**	**2,540**	**1,950**	**4,490**	**265**	**4,225**	**1,160**	**5,385**

WB SR 520 - PM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	985	95	885	1,255	2,130	240	1,890	1,110	3,000
HOV (2+)	80	10	75	100	185	20	165	75	240
Total	**1,065**	**105**	**960**	**1,355**	**2,315**	**260**	**2,055**	**1,185**	**3,240**

2030 No-Action

EB SR 520 - AM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	3,165	925	2,235	380	2,620	1,320	1,295	65	1,365
HOV (3+)	185	45	145	25	165	80	90	10	95
Total	**3,350**	**970**	**2,380**	**405**	**2,785**	**1,400**	**1,385**	**75**	**1,460**

EB SR 520 - PM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	4,565	1,460	3,105	345	3,455	2,030	1,410	55	1,475
HOV (3+)	550	170	380	40	415	270	160	10	160
Total	**5,115**	**1,630**	**3,485**	**385**	**3,870**	**2,300**	**1,570**	**65**	**1,635**

WB SR 520 - AM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	2,540	115	2,425	2,130	4,560	280	4,275	1,310	5,590
HOV (3+)	300	15	285	300	580	45	540	195	730
Total	**2,840**	**130**	**2,710**	**2,430**	**5,140**	**325**	**4,815**	**1,505**	**6,320**

WB SR 520 - PM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	1,190	115	1,070	1,470	2,545	275	2,265	1,290	3,560
HOV (3+)	75	5	75	60	130	15	120	45	160
Total	**1,265**	**120**	**1,145**	**1,530**	**2,675**	**290**	**2,385**	**1,335**	**3,720**

2030 Build

EB SR 520 - AM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	3,235	935	2,300	380	2,685	1,335	1,345	65	1,410
HOV (3+)	190	45	145	25	165	80	90	10	100
Total	**3,425**	**980**	**2,445**	**405**	**2,850**	**1,415**	**1,435**	**75**	**1,510**

EB SR 520 - PM Peak Hour

	Mainline	W. Lk. Sam. Pkwy off-ramp	Mainline	W. Lk. Sam. Pkwy on-ramp	Mainline	SR202 Off	Mainline	SR 202 On	Avondale
General Purpose	4,960	1,305	3,655	300	3,960	1,780	2,180	50	2,230
HOV (3+)	595	150	445	35	475	235	240	5	245
Total	**5,555**	**1,455**	**4,100**	**335**	**4,435**	**2,015**	**2,420**	**55**	**2,475**

WB SR 520 - AM Peak Hour

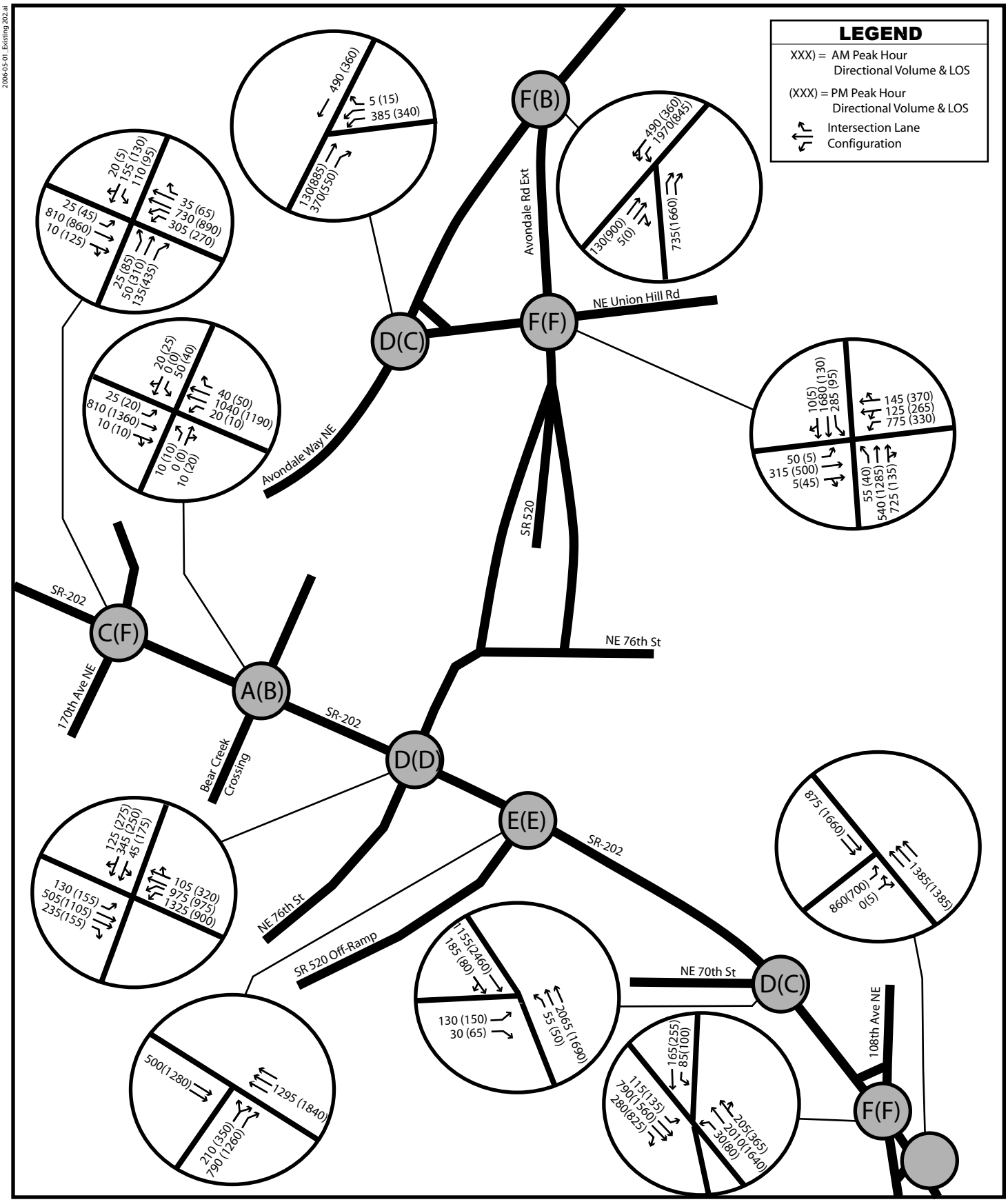
	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	2,805	100	2,700	2,045	4,750	250	4,495	1,180	5,675
HOV (3+)	330	15	320	285	600	40	565	175	740
Total	**3,135**	**115**	**3,020**	**2,330**	**5,350**	**290**	**5,060**	**1,355**	**6,415**

WB SR 520 - PM Peak Hour

	Avondale	SR 202 Off	Mainline	SR 202 On	Mainline	WLS Pkwy off-ramp	Mainline	WLS Pkwy on-ramp	Mainline
General Purpose	1,215	120	1,090	1,530	2,625	290	2,330	1,340	3,675
HOV (3+)	75	5	75	65	135	15	125	45	165
Total	**1,290**	**125**	**1,165**	**1,595**	**2,760**	**305**	**2,455**	**1,385**	**3,840**

APPENDIX B

Intersection Volumes, Geometric Configurations, and Levels of Service



Existing Peak Hour Volumes and Level of Service

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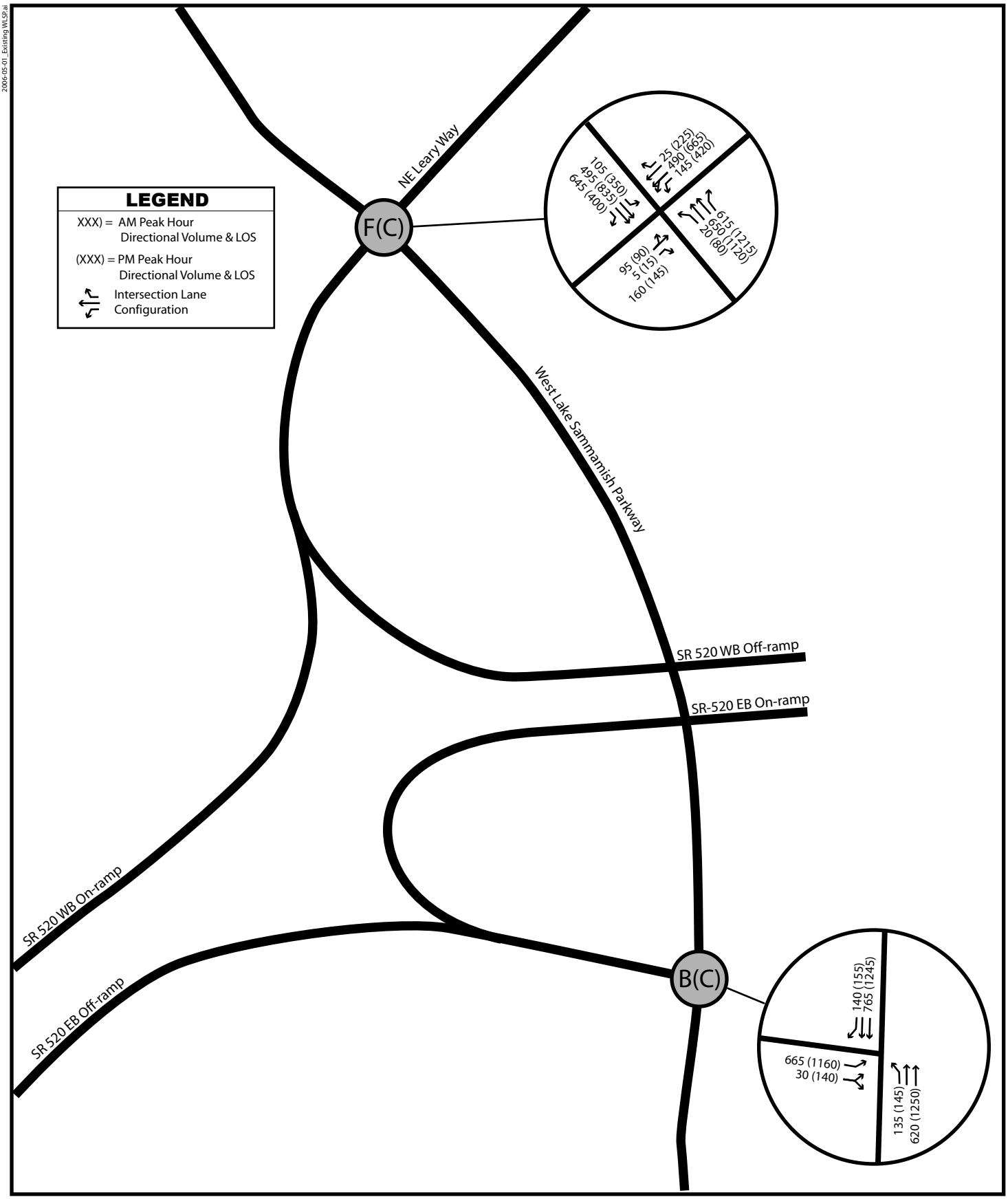

Existing Peak Hour Volumes and Level of Service

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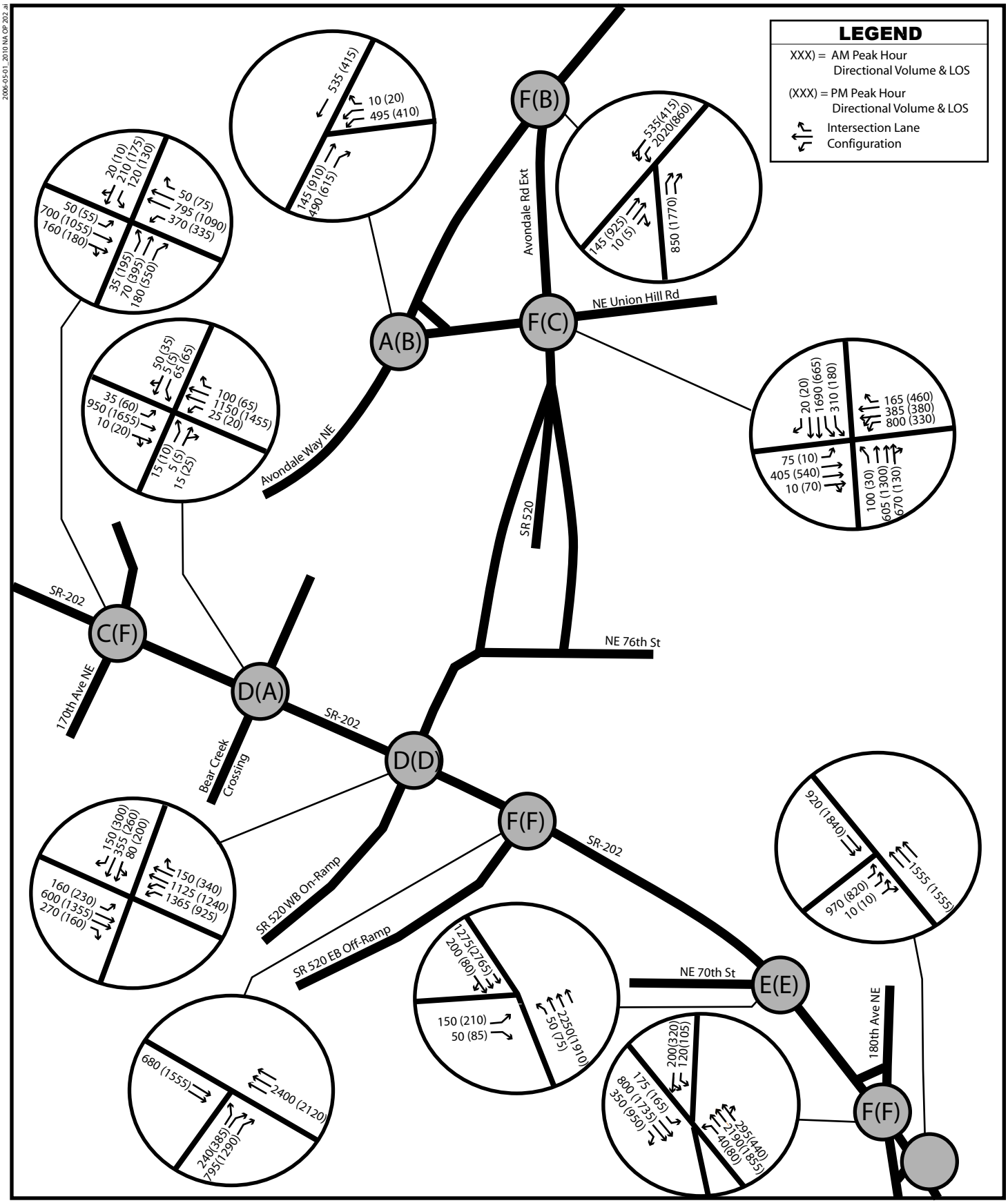

Year 2010 Peak Hour Volumes and Level of Service
No-action Scenario with
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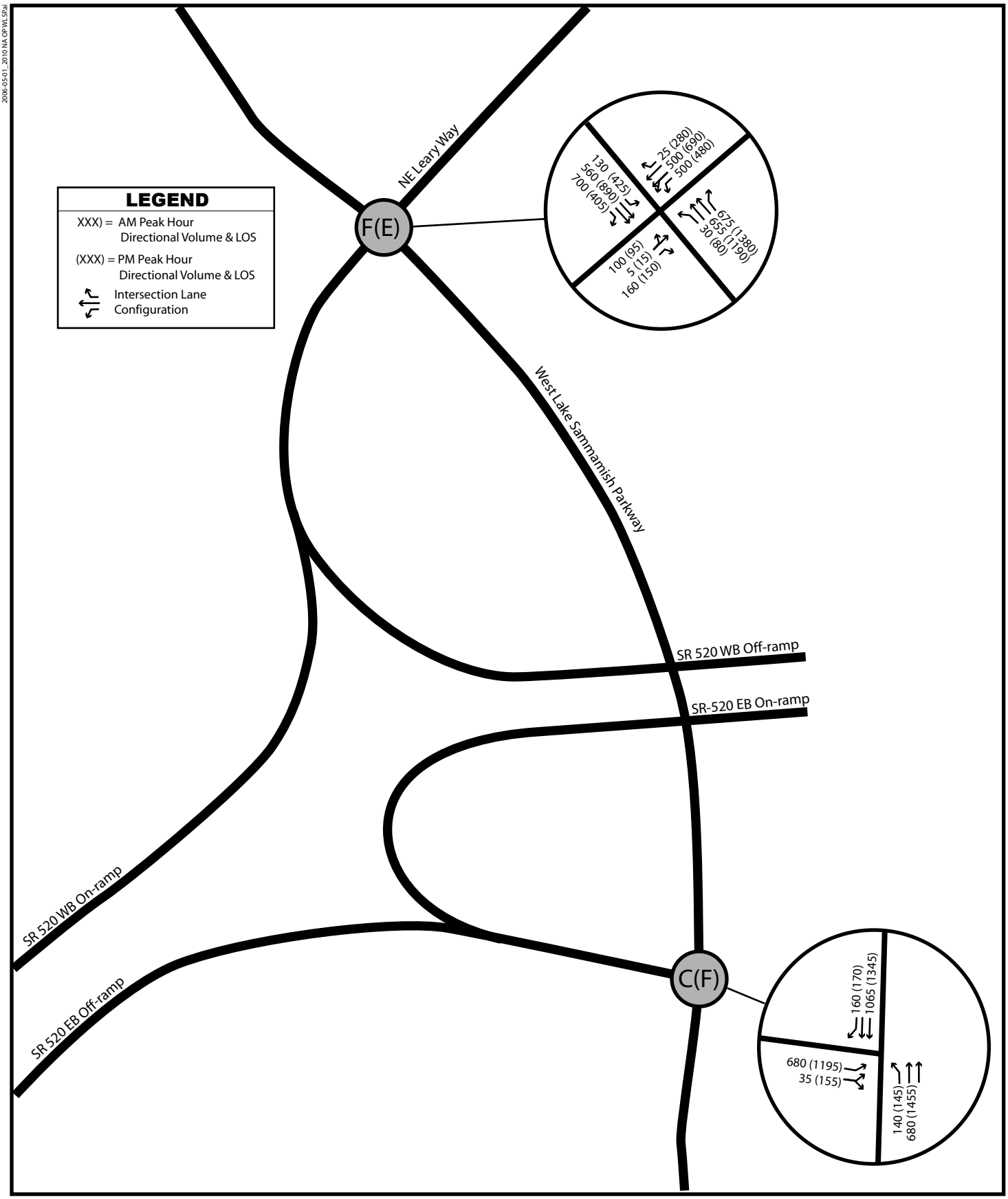

Year 2010 Peak Hour Volumes and Level of Service
No-action Scenario with
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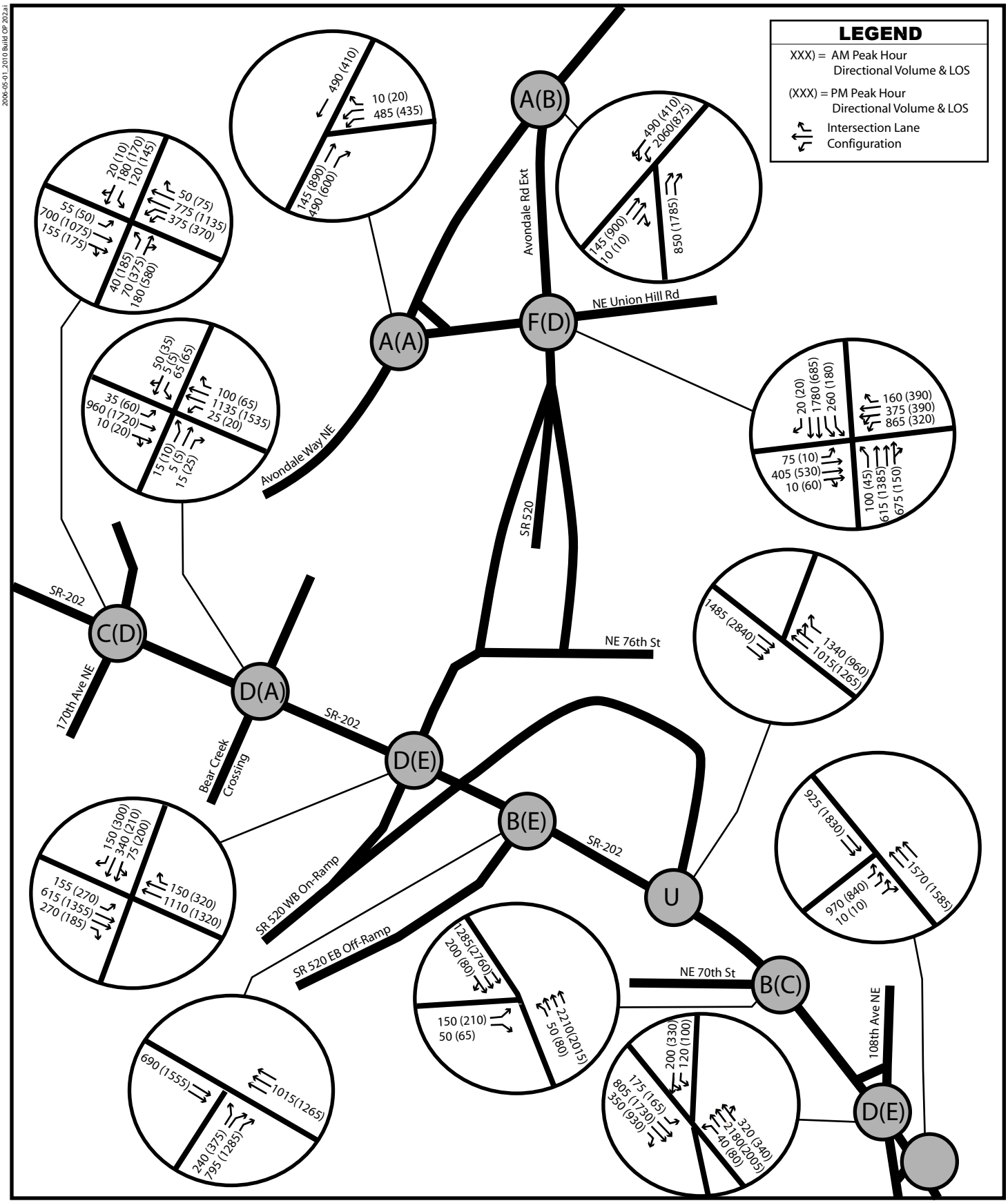
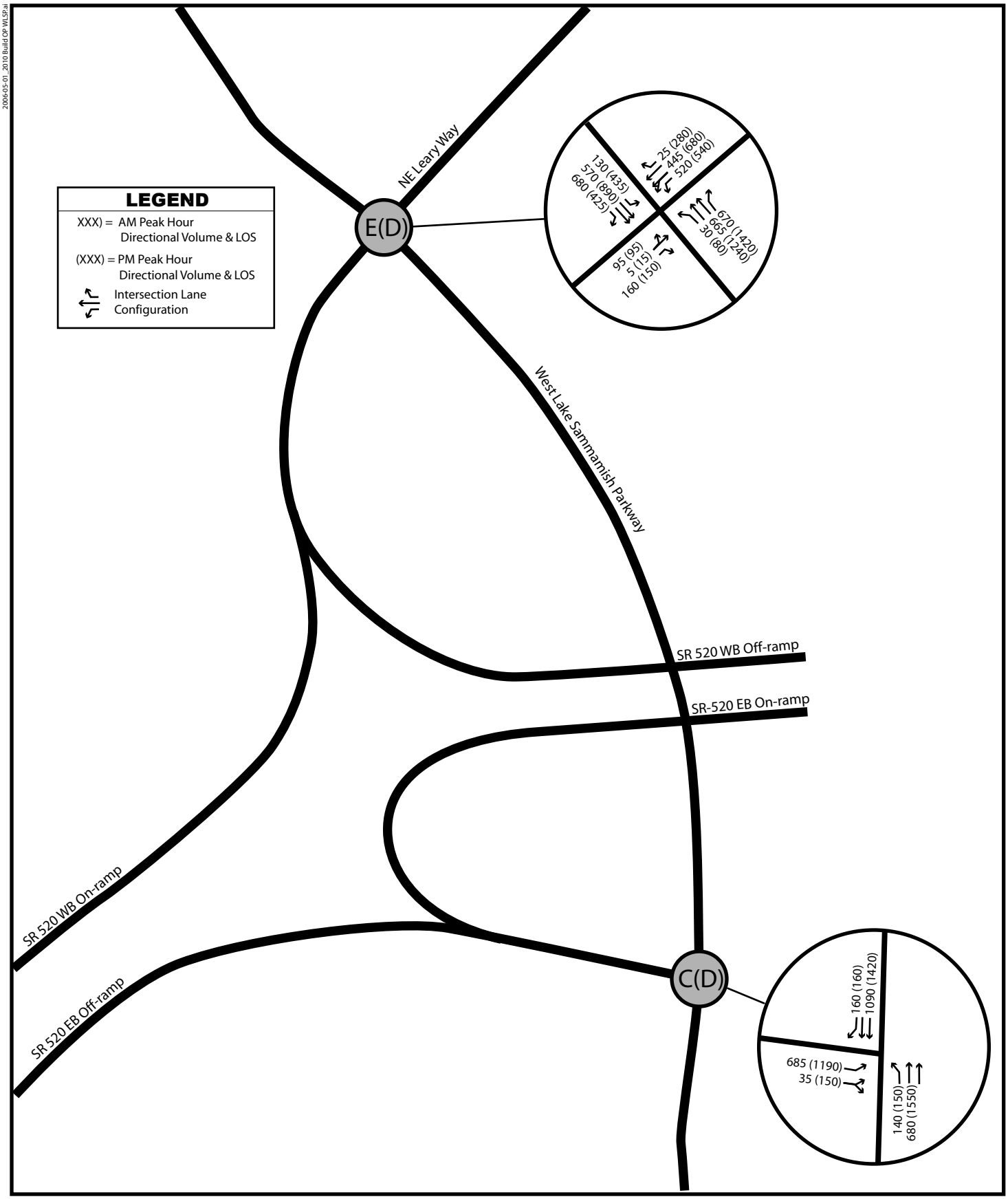
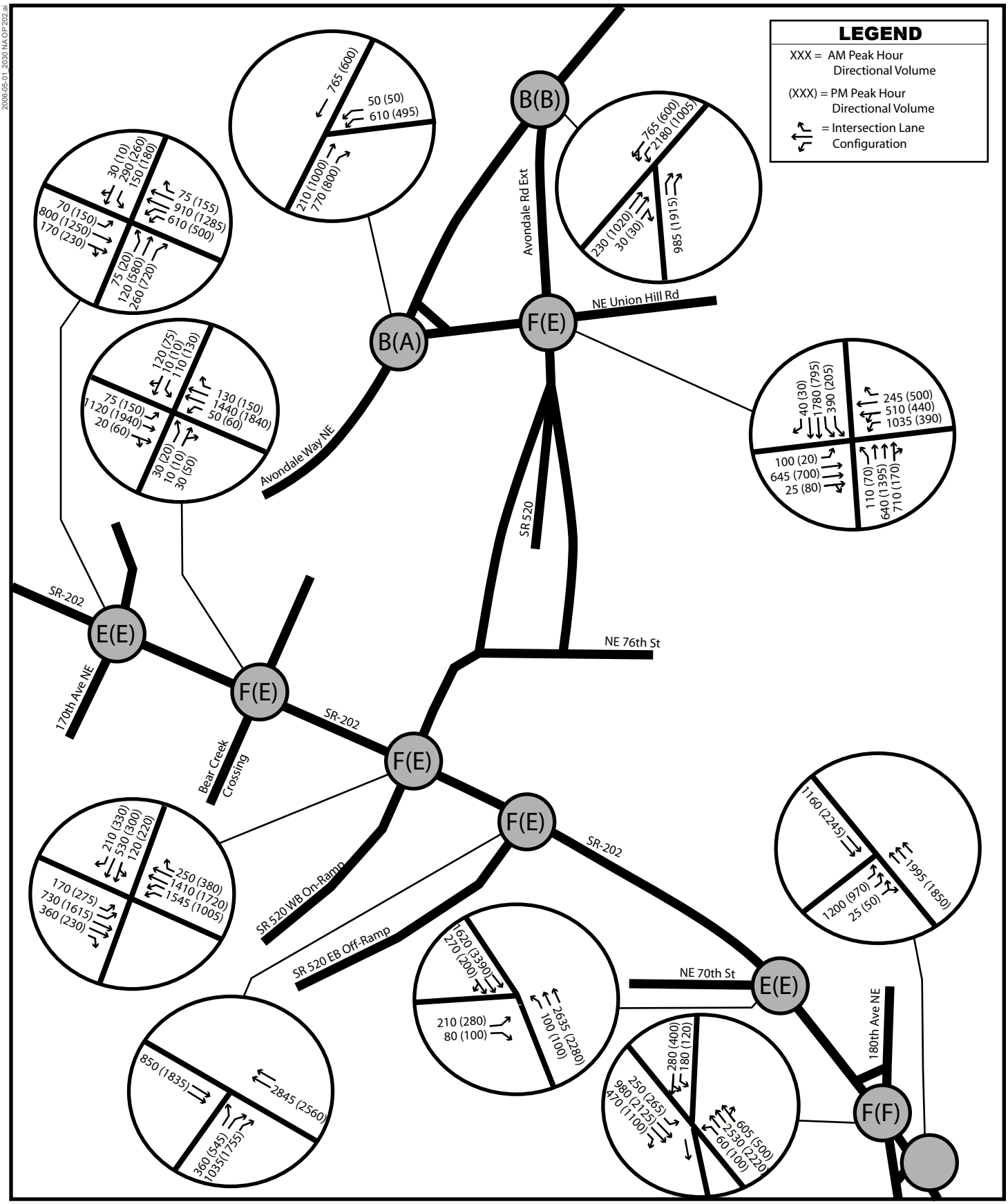


Year 2010 Peak Hour Volumes and Level of Service
Build Scenario with
Optimized Cycle Lengths



Year 2010 Peak Hour Volumes and Level of Service
Build Scenario with
Optimized Cycle Lengths



Year 2030 Peak Hour Volumes and Level of Service
No-Action Scenario with
Optimized Cycle Lengths

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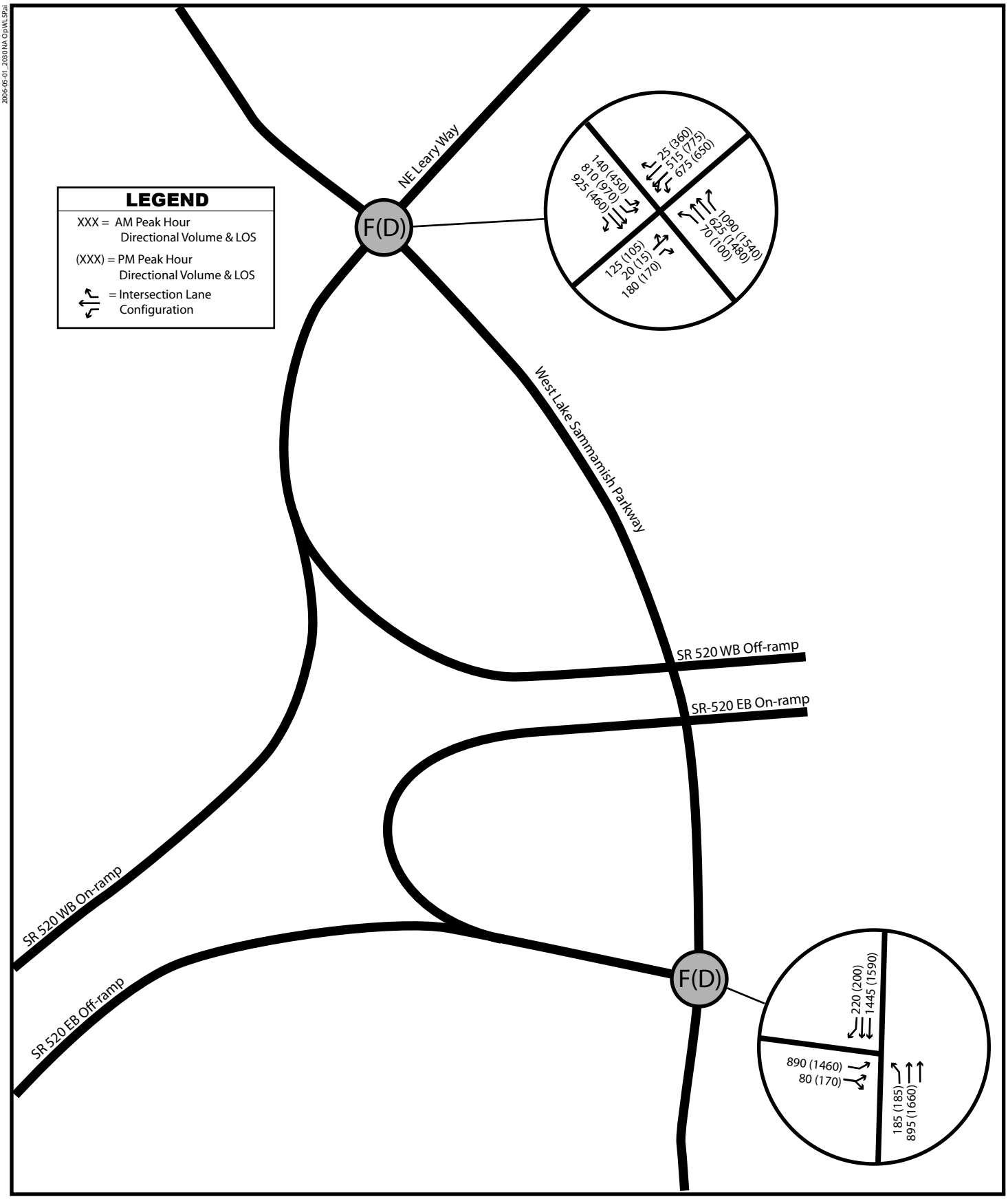
N.T.S



Year 2030 Peak Hour Volumes and Level of Service
No-action Scenario with
Optimized Cycle Lengths

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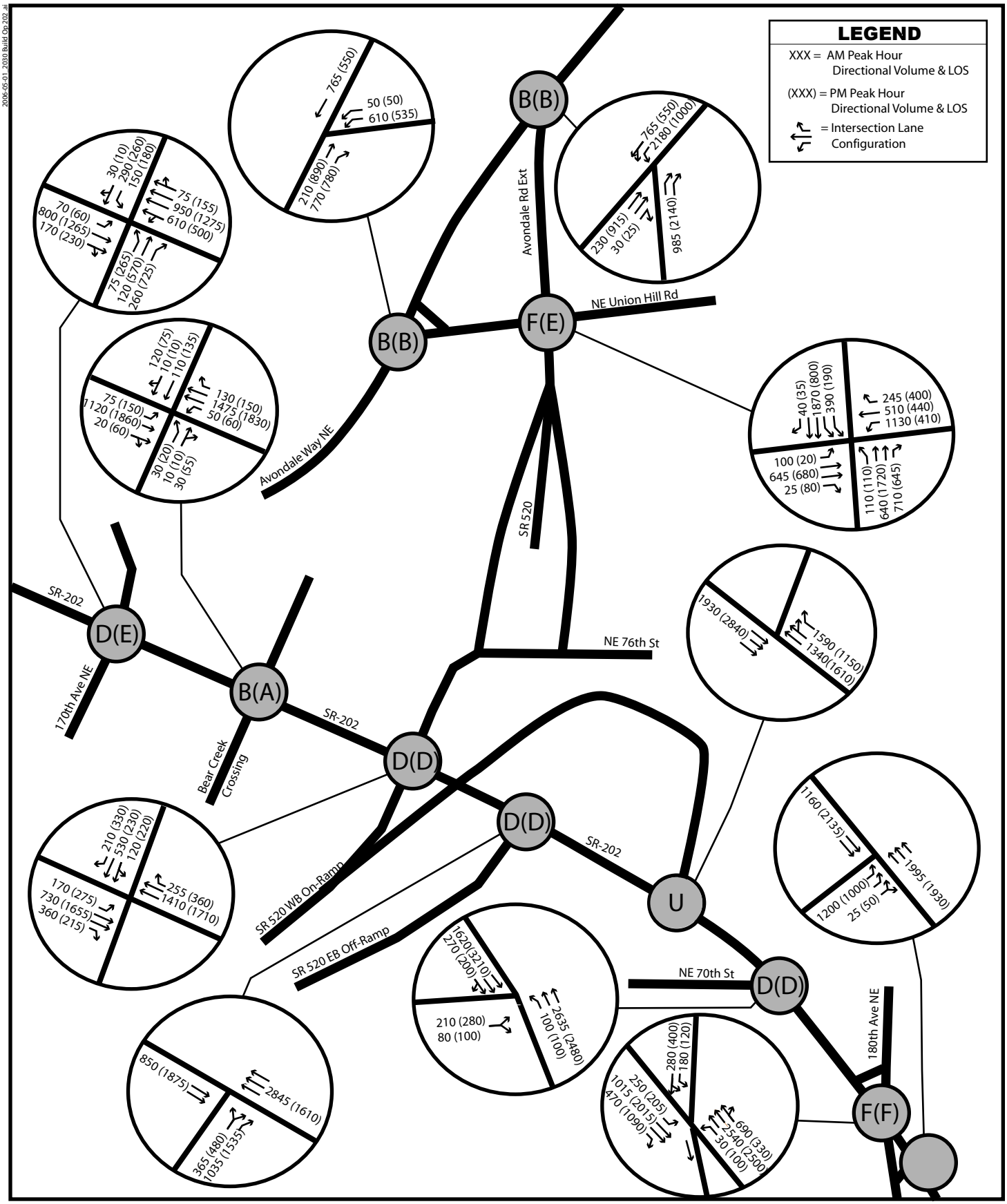
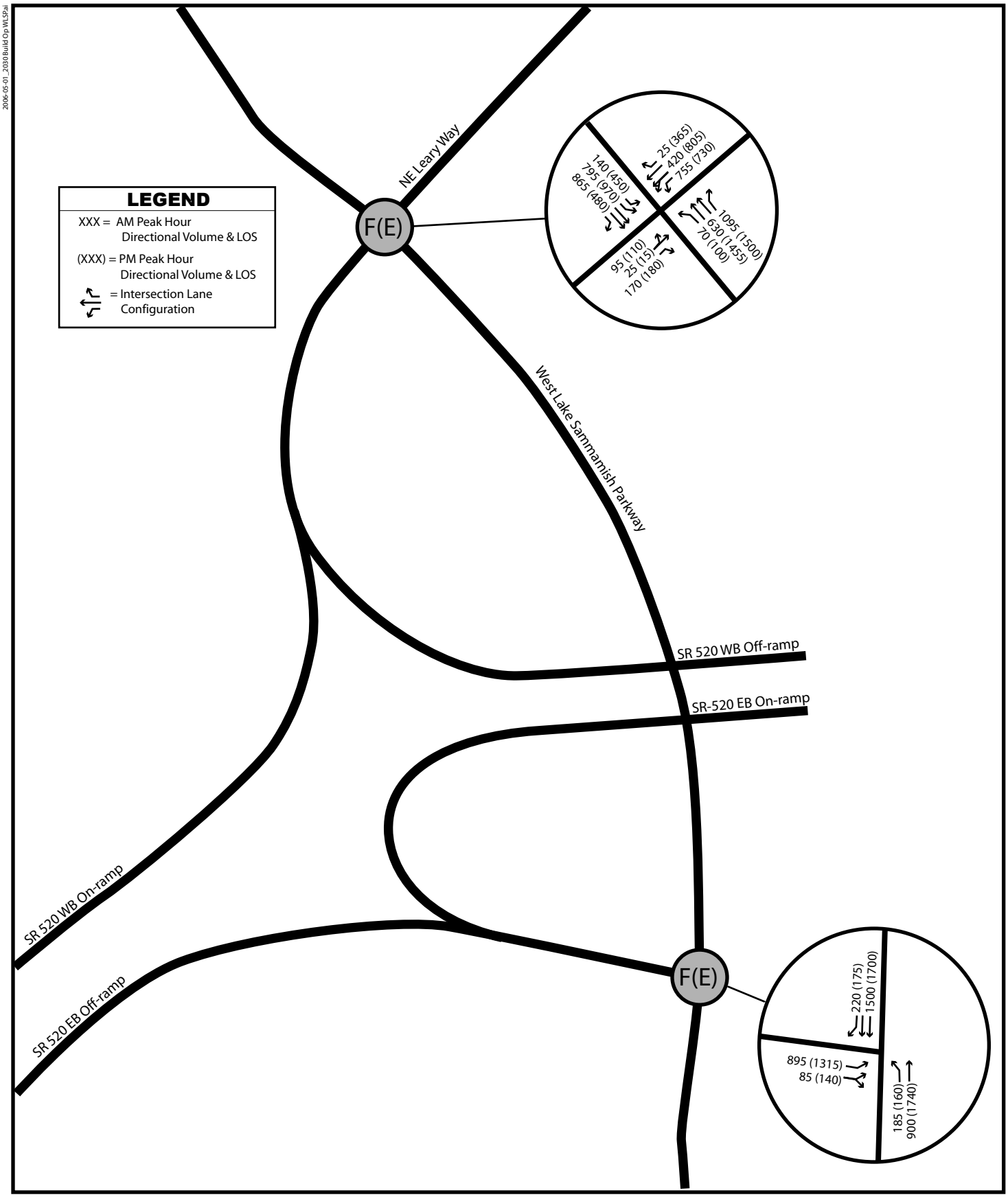


Year 2030 Peak Hour Volumes and Level of Service
Build Scenario with
Optimized Cycle Lengths



Year 2030 Peak Hour Volumes and Level of Service
Build Scenario with
Optimized Cycle Lengths

N
N.T.S